

Contents

LIST OF CONTRIBUTORS	v
FOREWORD	vii
CONTENTS OF PREVIOUS VOLUMES	xiii

H. S. W. Massey—A Sixtieth Birthday Tribute

E. H. S. Burhop

Text	1
------	---

Electronic Eigenenergies of the Hydrogen Molecular Ion

D. R. Bates and R. H. G. Reid

I. Introduction	13
II. Quantum Numbers	14
III. Calculation of Exact Eigenenergies	17
IV. Expansions	21
V. JWKB Approximation	23
Appendix	25
References	35

Applications of Quantum Theory to the Viscosity of Dilute Gases

R. A. Buckingham and E. Gal

I. Introduction	37
II. The Transition from Classical to Quantal Mechanics	38
III. Reduced Variables and Law of Corresponding States	39
IV. General Quantal Effects at Low Temperatures	43
V. Special Cases	47
References	60

Positrons and Positronium in Gases

P. A. Fraser

I. Introduction	63
II. The Fate of Positrons in Gases	65
III. Experimental Results	71
IV. Theoretical Results	87
V. Other Areas of Positron Atomic Physics	103
VI. Basic Questions	103
Review Works	104
References	105

Classical Theory of Atomic Scattering*A. Burgess and I. C. Percival*

I. Introduction	109
II. Classical Cross Sections	111
III. Binary Encounters	117
IV. Perturbation Theories and Threshold Laws	126
V. Orbit Integration and Monte Carlo Methods	128
VI. Correspondence Principle and Conclusions	137
References	139

Born Expansions*A. R. Holt and B. L. Moiseiwitsch*

I. Introduction	143
II. Born Expansion for the Scattering Amplitude	144
III. Convergence of Born Expansions	156
IV. Time-Dependent Collision Theory	162
V. Rearrangement Collisions	169
References	171

Resonances in Electron Scattering by Atoms and Molecules*P. G. Burke*

I. Introduction	173
II. Experimental Observations	175
III. Resonance Scattering Theory	186
IV. Further Results and Conclusions	208
References	214

Relativistic Inner Shell Ionization*C. B. O. Mohr*

I. Introduction	221
II. Relativistic Wave Functions	221
III. Inner Shell Energies	224
IV. <i>K</i> Ionization by Electrons	226
V. Ionization by Protons	231
VI. Ionization by Photons	233
References	235

Recent Measurements on Charge Transfer*J. B. Hasted*

I. Introduction	237
II. Total Cross Sections for the Symmetrical Resonance Process	237

III. Total Charge Transfer Cross Sections for Unlike Ions and Atoms	242
IV. Differential Scattering with Capture	243
V. Pseudocrossing of Potential Energy Curves	246
VI. Molecular Charge Transfer Processes at Low Energies	248
VII. Experimental Techniques	249
VIII. Role of Excited Species	254
IX. Miscellaneous Topics	259
References	263

Measurements of Electron Excitation Functions

D. W. O. Heddle and R. G. W. Keesing

I. Introduction	267
II. The Excitation Equilibrium	267
III. The Angular Distribution of the Light	278
IV. Simultaneous Ionization and Excitation	281
V. High Resolution Measurements	284
VI. Time-Resolved Measurements	289
VII. Related Measurements	292
VIII. Comparison of Observations	294
References	296

Some New Experimental Methods in Collision Physics

R. F. Stebbings

I. Introduction	299
II. Flowing Afterglows	300
III. Merged Beams	304
IV. Ion Beam Measurements	308
V. Electron Beam Measurements	318
VI. Photoelectron Spectroscopy	324
VII. Metastable Atom Measurements	327
References	329

Atomic Collision Processes in Gaseous Nebulae

M. J. Seaton

I. Introduction	331
II. Recombination Spectra	332
III. The Forbidden Lines	356
References	378

Collisions in the Ionosphere

A. Dalgarno

I. Introduction	381
II. The Slowing Down of Fast Electrons	382

III. Electron Cooling Processes	390
IV. Ion Cooling Processes	394
V. Ion-Molecule Reactions	399
VI. The Slowing Down of Fast Protons	405
References	405
The Direct Study of Ionization in Space	
<i>R. L. F. Boyd</i>	
I. Introduction	411
II. The Space Situation	412
III. Theory of Electron and Ion Probes	417
IV. Ungridded Probe Systems	423
V. Gridded Probe Systems	428
VI. Transverse Field Analyzers	433
VII. Ion Mass Spectrometers	437
References	441
AUTHOR INDEX	443
SUBJECT INDEX	458