Contents

LIST OF CONTRIBUTORS vii

Atomic and Molecular Polarizabilities—A Review of Recent Advances

Thomas M. Miller and Benjamin Bederson

I. Introduction 1
II. The Calculation of Polarizabilities 10
III. Experimental Measurements of Polarizabilities 21
IV. Future Possibilities for Polarizabilities 47
References 51

Study of Collisions by Laser Spectroscopy

Paul R. Berman

I. Introduction 57
II. Collisions 60
III. Three-Level Systems 65
IV. Transient Systems 90
V. Experimental Survey—Theoretical Outlook 100
VI. Conclusions 106
References 110

Collision Experiments with Laser Excited Atoms in Crossed Beams

I. V. Hertel and W. Stoll

I. Introduction 113
II. Basic Theory 117
III. Excitation of Atoms by Laser Optical Pumping 129
IV. Theory of Measurements in Scattering Experiments by Laser-Excited Atoms 157
V. Collision Experiments 174
VI. Atomic Scattering Processes in the Presence of Strong Laser Fields 211
VII. Conclusions 223
References 224

Scattering Studies of Rotational and Vibrational Excitation of Molecules

Manfred Faubel and J. Peter Toennies

I. Introduction 229
II. Potential Hypersurfaces 238
III. Inelastic Scattering Theory 248
IV. Experimental Methods 257
V. Recent Experimental Results 274
VI. Summary 307
References 308

Low-Energy Electron Scattering by Complex Atoms: Theory and Calculations

R. K. Nesbet

I. Introduction 315
II. Theory 318
III. Methods 337
IV. Applications 349
References 378

Microwave Transitions of Interstellar Atoms and Molecules

W. B. Somerville

I. Introduction 383
II. Spectroscopic Formulas 385
III. Atomic Hyperfine Structure 387
IV. Atomic Fine Structure 390
V. Recombination Lines 394
VI. Structure in Diatomic Molecules 397
VII. Transitions in Diatomic Molecules 403
VIII. Rotation in Polyatomic Molecules 422
IX. Inversion in NH_3 428
References 430

AUTHOR INDEX 437
SUBJECT INDEX 451
CONTENTS OF PREVIOUS VOLUMES 459