

Contents

General introduction	see subvolume I/17A
1 Photon interactions with atoms	see subvolume I/17A
2 Electron collisions with atoms	see subvolume I/17A
3 Electron collisions with atomic ions	3-1
3.1 Excitation (A.K. PRADHAN, H.L. ZHANG)	3-1
3.1.1 Introduction	3-1
3.1.2 Theory	3-2
3.1.2.1 Definitions and formulae	3-2
3.1.2.2 Principal methods	3-3
3.1.2.2.1 The close coupling approximation and the R-matrix method	3-3
3.1.2.2.2 The distorted wave and the relativistic distorted wave approximations	3-4
3.1.2.2.3 High partial waves and the Coulomb-Bethe approximation	3-5
3.1.2.2.4 The Iron Project	3-5
3.1.2.3 Atomic effects	3-6
3.1.2.3.1 Electron exchange	3-6
3.1.2.3.2 Channel-coupling	3-6
3.1.2.3.3 Target representation	3-7
3.1.2.3.4 Relativistic effects	3-7
3.1.2.3.5 Radiation damping of autoionizing resonances	3-8
3.1.3 Comparison with experiments	3-9
3.1.4 Scaling laws, analysis of data, and databases	3-18
3.1.5 Data tables and accuracy ratings	3-19
3.1.5.1 Theoretical data sources	3-19
3.1.5.2 Effective collision strengths, wavelengths, and A -values	3-30
3.1.5.3 Excitation data for iron ions	3-41
3.1.6 References for 3.1	3-96
3.2 Ionization (H. TAWARA)	3-103
3.2.1 Introduction and general description	3-103
3.2.2 Experimental techniques for ion targets	3-103
3.2.3 Contribution of various processes to ionization	3-105
3.2.3.1 Direct processes	3-105
3.2.3.2 Indirect processes	3-106
3.2.4 Experimental results of ionization cross sections of ions	3-107
3.2.4.1 General features of the ionization cross section behavior	3-107
3.2.4.2 High resolution ionization cross section measurements of indirect processes . .	3-109
3.2.4.3 Ionization of relativistic electrons	3-114
3.2.5 Short description of theories	3-116
3.2.6 Evaluated ionization cross sections for ions	3-116

3.2.7	Empirical formula for ionization cross sections	3-127
3.2.7.1	H- and He-like ions	3-127
3.2.7.2	Li-like ions	3-127
3.2.7.3	Empirical formula for excitation for many-electron systems.	3-128
3.2.7.4	Empirical formula for multiple ionization	3-128
3.2.7.5	Ionization rate coefficients	3-128
3.2.8	References for 3.2	3-129
Appendix	Data sources for the experimental ionization cross sections of atomic ions	3-130
3.3	Electron ion recombination processes (Y. HAHN)	3-140
3.3.1	Introduction	3-140
3.3.2	General discussion	3-141
3.3.2.1	The recombination amplitudes and cross sections	3-142
3.3.2.2	Rate coefficients, electron velocity distributions and cascades	3-144
3.3.3	Direct processes	3-145
3.3.3.1	Radiative recombination (RR)	3-146
3.3.3.2	Three-body recombination (TBR)	3-148
3.3.4	Indirect processes - dielectronic recombination	3-150
3.3.5	Plasma density effects - field and collisional perturbations	3-153
3.3.6	Conclusion	3-155
3.3.7	Explanation for the use of tables	3-156
3.3.8	Tables	3-157
3.3.9	References for 3.3	3-209
3.4	Electron detachment from negative ions (H. TAWARA)	3-211
3.4.1	Introduction	3-211
3.4.2	Electron detachment cross sections	3-212
3.4.2.1	Negative hydrogen ions	3-212
3.4.2.2	Heavier negative ions	3-215
3.4.3	Theoretical treatments	3-216
3.4.3.1	Single-electron detachment	3-216
3.4.3.2	Double-electron detachment	3-216
3.4.4	Empirical formulas for electron detachment	3-217
3.4.4.1	Single-electron detachment	3-217
3.4.4.2	Double-electron detachment	3-217
3.4.5	Resonance states in electron detachment under electron impact	3-217
3.4.6	References for 3.4	3-218