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BIBLIOGRAPHY ON ELECTRON COLLISIONS WITH ATOMIC POSITIVE IONS: 1940 THROUGH 1977

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PREFACE

This bibliography includes the relevant references published until the end of 1977. This is mainly the results of our personal efforts. We are not to claim that this is nearly the complete list. It is likely that many further references must be added in future to this bibliography. Nevertheless, we hope that this is of some value for fusion research, astrophysics, as well as atomic collision research itself. No selection has been made, so that it is the future task to evaluate the reliability of the numerical data reported in each reference.

Brief remarks are put to each reference. These remarks include the target ion species and the processes treated and indicate some features of the article. However, these do not necessarily cover the whole feature of the work.

The first part is for the experimental references and the second for the theoretical ones. Each part contains the index at the end.

K. Takayanagi

REVIEW ARTICLES

ON THE ELECTRON IMPACT EXCITATION AND IONIZATION

OF POSITIVE IONS

L.J.Kieffer and G.H.Dunn, Rev. Mod. Phys. 38, 1 (1966)
Electron impact ionization cross section data for atoms, atomic ions, and diatomic molecules : I. Experimental data.

K.T.Dolder, "Case Studies in Atomic Collision Physics 1" ed. E.W.McDaniel and M.R.C.McDowell (North-Holland) Chap. 5, p.249 (1969)
Experiments with colliding charged-particle beams.

A.H.Gabriel and C.Jordan, "Case Studies in Atomic Collision Physics 2" ed E.W.McDaniel and M.R.C.McDowell (North-Holland) Chap. 4, p.209 (1972)
Interpretation of spectral intensities from laboratory and astrophysical plasmas.

M.J.Seaton, Adv. Atom. Molec. Phys. 11, 83 (1975)
Electron impact excitation of positive ions.

K.T.Dolder and B.Peart, Rep. Prog. Phys. 39, 693 (1976)
Collisions between electrons and ions.

A.Burgess, H.P.Summers, D.M.Cochrane and R.W.P.McWhirter, Mon. Not. R. Astro. Soc. 179, 275 (1977)
Cross-sections for ionization of positive ions by electron impact.

ELECTRON IMPACT EXCITATION AND IONIZATION OF POSITIVE ATOMIC IONS

(EXPERIMENTAL)

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61 E1	K.T.Dolder, M.F.A.Harrison and P.C.Thonemann, Proc. Roy. Soc. A264, 367 (1961) A measurement of the ionization cross-section of helium ions by electron impact.	He^+: Ioniz. 54-1000eV crossed-beam
62 E1	M.F.A.Harrison, K.T.Dolder and P.C.Thonemann, Ioniz. Phenom. in Gases, ed. by H.Maecker, vol.2, p.1251 (1962) The measurement of the ionization cross sections of ions by electron impact.	He^+: Ioniz. 54-1000eV crossed-beam
63 E1	K.T.Dolder, M.F.A.Harrison and P.C.Thonemann, Proc. Roy. Soc. A274, 546 (1963) A measurement of the ionization cross section of Ne^+ to Ne^{2+} by electron impact.	Ne^+: Ioniz. 50-1000eV crossed-beam
63 E2	M.F.A.Harrison, K.T.Dolder and P.C.Thonemann, Proc. Phys. Soc. 82, 368 (1963) A measurement of the cross section for the ionization of N^+ to N^{2+} by electron impact.	N^+: Ioniz. 20-500eV crossed-beam
63 E3	S.E.Kupriyanov and Z.Z.Latypov, JETP USSR 45, 815 (1963); Sov. Phys. JETP 18, 558 (1964) Ionization of positive ions by electron impact.	Hg^+, Xe^+, Kr^+ : Ioniz. 10-500eV crossed-beam
64 E1	Z.Z.Latypov, S.E.Kupriyanov and N.N.Tunitskii, JETP USSR 46, 833 (1964); Sov. Phys. JETP 19, 570 (1964) Ionization encounters of electrons with ions and atoms.	Ne^+, Ar^+, Kr^+, Hg^+, Ar^{2+}, Kr^{2+}, Xe^{2+}, Hg^{2+}: Ioniz. 10-500eV crossed-beam
65 E1	F.A.Baker and J.B.Hasted, 4th ICPEAC, p.447 (1965) Ionisation d'ions positifs par impact d'electrons.	Kr^+ : Ioniz.(rel.) 24-40eV trapped-ion
66 E1	F.A.Baker and J.B.Hasted, Phil. Trans. Roy. Soc. A261, 33 (1966) Electron collision studies with trapped positive ions.	Ne^+, Ar^+, Kr^+, Xe^+: Ioniz. (rel.) trapped-ion
66 E2	D.F.Dance, M.F.A.Harrison and A.C.H.Smith, Proc. Roy. Soc. A290, 74 (1966) A measurement of the cross section for production of $He^+(2S)$ ions by electron impact excitation of ground state helium ions.	He^+: Exc.[1s→2s] (rel.) T-750eV crossed-beam
66 E3	E.Hinnov, J. Opt. Soc. Am. 56, 1179 (1966) Excitation and ionization rates of neon ions in a stellarator discharge.	Ne^{n+}(n=1 to 7): Exc. & ioniz rate Te, 10-50eV plasma

66 E4	W.C.Lineberger, J.W.Hooper and E.W.McDaniel, Phys. Rev. 141, 151 (1966) Absolute cross sections for single ionization of alkali ions by electron impact. I. Description of apparatus and Li^+ results.	Li^+: Ioniz. 76-800eV crossed-beam
66 E5	J.W.Hooper, W.C.Lineberger and F.M.Bacon, Phys. Rev. 141, 165 (1966) Absolute cross sections for single ionization of alkali ions by electron impact. II.Na^+ and K^+ results and comparison with theory.	Na^+, K^+: Ioniz. T-1000eV crossed-beam
67 E1	N.R.Daly and R.E.Powell, Phys. Rev. Lett. 19, 1165 (1967) Electron-impact excitation of the 2S state and auto-ionization below the n=3 level of He^+(experimental).	He^+: Exc.[1s→2s] (rel.) 41-54eV trapped-ion
67 E2	R.C.Elton and W.W.Koeppendoerfer, Phys. Rev. 160, 194 (1967) Measured collisional excitation rate coefficients for oxygen VII.	O^{6+}: Exc. rate to [n=2, triplet & singlet] Te, (250±60)eV plasma
67 E3	A,M.Emel'yanov, Yu.S.Khodeyev and L.N.Gorokhov, 5th ICPEAC, p.46 (1967) Electron impact ionization of Cs^+ ions.	Cs^+: Ioniz.(rel.) near threshold trapped-ion
67 E4	E.Hinnov, J. Opt. Soc. Am. 57, 1392 (1967) Revision of the temperature dependence of the ionization rates of neon ions.	Revise Te value in 66 E3
67 E5	P.A.Redhead, Can. J. Phys. 45, 1791 (1967) Multiple ionization of the rare gas by successive electron impacts (0-250 eV).	He^+, $Ne^{n+}(1\leq n\leq 5)$ $Ar^{n+}(1\leq n\leq 6)$, Kr^{n+} $(1\leq n\leq 7)$, $Xe^{n+}(1\leq n\leq 10)$: Ioniz.(rel.) 0-250eV trapped-ion
67 E6	J.B.Wareing and K.T.Dolder, 5th ICPEAC, p.43 (1967) Measurement of cross sections for the ionization of Li^+ to Li^{2+} by electron impact.	Li^+: Ioniz. 75-1000eV crossed-beam
67 E7	J.B.Wareing and K.T.Dolder, Proc. Phys. Soc. 91, 887 (1967) A measurement of the cross section for ionization of Li^+ to Li^{2+} by electron impact.	Li^+: Ioniz. 75-1000eV crossed-beam

68 E1	H.-J.Kunze, A.H.Gabriel and H.R.Griem, Phys. Rev. 165, 267 (1968) Measurement of collisional rate coefficients for helium like carbon ions in a plasma.	C^{4+}: Exc. rate [G to n=2 singlet; n=2 triplet to n=2 singlet] : Ioniz. rate from G & n=2 triplet Te, 205-240eV plasma
68 E2	P.Mahadevan, Douglas Adv. Res. Lab. Res. Communic. 84, (1968) Electron impact ionization of positive ions and atoms using a coaxial beam technique.	He^{+}: Ioniz.(rel.) T-300eV merging-beam
68 E3	S.O.Martin, B.Peart and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 1, 537 (1968) Measurements of cross sections for the ionization of Mg^{+} to Mg^{2+} by electron impact.	Mg^{+}: Ioniz. T-2000eV crossed-beam
68 E4	A.N.Prased and M.F.El-Menshawy, J. Phys. B: Atom. Molec. Phys. 1, 471 (1968) Triplet to singlet excitation of C V ions in high-temperature plasmas.	C^{4+}: Exc. rate to n=2; Te, 40eV plasma
68 E5	B.Peart and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 1, 240 (1968) Measurements of cross sections for the ionization of Na^{+} to Na^{2+} and K^{+} to K^{2+} by electron impact.	Na^{+}, K^{+}: Ioniz. T-3500eV crossed-beam
68 E6	B.Peart and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 1, 872 (1968) Measurements of cross sections for the ionization of Li^{+} and Ba^{+} ions by electron impact.	Li^{+}, Ba^{+}: Ioniz. T-3 and 2keV, resp. crossed-beam
68 E7	P.A.Redhead and S.Feser, Can. J. Phys. 46, 865 (1968) Multiple ionization of the rare gas by successive electron impacts (0-250 eV). II. 1S-2S transition in $^{3}He^{+}$.	He^{+}: Exc. [1s→2s] (rel.), 0-250eV trapped-ion
68 E8	P.A.Redhead and S.Feser, Can. J. Phys. 46, 1905 (1968) Multiple ionization of mercury by successive electron impacts.	$Hg^{n+}(1\leq n\leq 9)$: Ioniz. (rel.), 0-250eV trapped-ion
69 E1	K.L.Aitken, M.F.A.Harrison and R.D.Rundel, 6th ICPEAC, p.614 (1969) Electron impact ionization of ions of atmospheric gases.	N^{2+}: Ioniz. 10-900eV crossed-beam

69 E2	F.M.Bacon and J.W.Hooper, Phys. Rev. 178, 182 (1969) Relative experimental cross sections for excitation of Ba^+ ions by electron impact (8.0-98 eV).	Ba^+: Exc.[$6^2S_{1/2}\rightarrow 6^2P_{1/2}$ & $6^2P_{3/2}$] (rel.), 8.0-98eV crossed-beam
69 E3	M.T.Elford, R.K.Feeney and J.W.Hooper, 6th ICPEAC, p.620 (1969) Absolute experimental cross sections for single ionization of Ba^+ ions by electron impact.	Ba^+: Ioniz. T-1000eV crossed-beam
69 E4	M.O.Pace and J.W.Hooper, 6th ICPEAC, p.266 (1969) Absolute experimental cross sections for excitation of Ba^+ ions by electron impact.	Ba^+: Exc.[$6^2S_{1/2}\rightarrow 6^2P_{1/2}$ & $6^2P_{3/2}$] 2.5-10eV crossed-beam
69 E5	P.Mahadevan, 6th ICPEAC, p.617 (1969) Ionization of positive ions of atomic and molecular nitrogen by electrons.	N^+: Ioniz.(rel.) 0-250eV merging-beam
69 E6	B.Peart, S.O.Martin and K.T.Dolder, 6th ICPEAC, p.1 (1969) Recent measurements of cross sections for the ionization of ions by electron impact.	Li^+: Ioniz.to Li^{2+} & Li^{3+}up to 2.5keV Mg^{2+}: Ioniz. crossed-beam
69 E7	B.Peart and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 2, 1169 (1969) The ionization of Li^+ to Li^{3+} by electron impact.	Li^+: Ioniz.to Li^{3+} T-2.5keV crossed-beam
69 E8	B.Peart, S.O.Martin and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 2, 1176 (1969) Measurements of electron impact ionization cross section of Mg^{2+} ions and a note on the classical scaling law.	Mg^{2+}: Ioniz. T-3keV crossed-beam
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69 E10	P.A.Redhead, Can. J. Phys. 47, 2449 (1969) Multiple ionization in carbon monoxide by successive electron impacts.	$C^{n+}(1\leqslant n\leqslant 4)$, $O^{n+}(1\leqslant n\leqslant 6)$: Ioniz.(rel.) 0-200eV trapped-ion

70 E1	I.L.Beigman, L.A.Vainshtein, A.P.Dronov and E.M.Kudryavtsev, JETP USSR 59, 1991 (1970); Sov. Phys. JETP 32, 1079 (1971) Effective cross sections for electron excitations of transitions between excited states of the ions Ba^+ and Sr^+.	Ba^+, Sr^+: Exc.rate [$7^2S \rightarrow 7^2P$], [$5^2D_{5/2} \rightarrow 6^2D_{3/2}$], resp. (rel.) from spectr. linewidth Te, 1.25×10^4K plasma
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70 E3	P.A.Redhead, Can. J. Phys. 48, 1906 (1970) Sequential-impact mass spectroscopy; pressure dependence of ion currents from trapped-ion sources.	Ne^{n+}, Ar^{m+}: Ioniz. ($1 \leq n \leq 4$), ($1 \leq m \leq 5$) (rel.), 0-200eV trapped-ion
71 E1	K.L.Aitken and M.F.A.Harrison, J. Phys. B: Atom. Molec. Phys. 4, 1176 (1971) Measurements of the cross sections for electron impact ionization of multi-electron ions. I. O^+ to O^{2+} and O^{2+} to O^{3+}.	O^+, O^{2+}: Ioniz. up to 997 & 498eV, resp. crossed-beam
71 E2	K.L.Aitken, M.F.A.Harrison and R.D.Rundel, J. Phys. B: Atom. Molec. Phys. 4, 1189 (1971) Measurement of the cross sections for electron impact ionization of multi-electron ions. II. N^{2+} to N^{3+} and C^+ to C^{2+}.	C^+, N^{2+}: Ioniz. up to 798 & 898eV, resp. crossed-beam
71 E3	W.D.Johnston III and H.-J.Kunze, Phys. Rev. A4, 962 (1971) Measurements of collisional-excitation rate coefficients for berylliumlike ions.	N^{3+}, O^{4+}, Ne^{6+}, Si^{8+}: Exc. rate to [n=2,3,4 states] Te, 67-260eV plasma
71 E4	H.-J.Kunze, Phys. Rev. A3, 937 (1971) Collisional ionization rates for lithium- and beryllium-like ions.	C^{3+}, N^{4+}, $O^{4+,5+}$, Ne^{6+} : Ioniz. rate Te, 100-260eV plasma
71 E5	H.-J.Kunze and W.D.Johnston III, Phys. Rev. A3, 1384 (1971) Experimental rate coefficients for collisional excitation of lithiumlike ions.	N^{4+}, O^{5+}, Ne^{7+}: Exc. rate[2s→2p] Te, 110-260eV plasma
71 E6	H.-J.Kunze, Phys. Rev. A4, 111 (1971) Collisional excitation of the 4^2F levels in lithium-like Ne VIII.	Ne^{7+}: Exc. rate [2s→4p,4f] Te, 125-260eV plasma

71 E7	P.O.Taylor and G.H.Dunn, 7th ICPEAC, p.696 (1971) Crossed beam measurement of the cross sections for electron impact excitation of the H and K lines of Ca II.	Ca^+: Exc.[$4^2S_{1/2}\rightarrow 4^2P_{3/2,1/2}$] (rel.) T-100eV crossed-beam
71 E8	G.Tondello and R.W.P.McWhirter, J. Phys. B: Atom. Molec. Phys. 4, 715 (1971) Measurements of excitation rate coefficients for singlet and triplet transitions of neon VII.	Ne^{6+}: Exc. rate [2s→2p,3s,3d etc.] Te, 2.1×10^6K plasma
71 E9	P.A.Redhead and C.P.Gopalaraman, Can. J. Phys. 49, 585 (1971) Multiple ionization of cesium and barium by successive electron impact.	Cs^{n+}, Ba^{m+}: Ioniz. ($1\leqslant n\leqslant 9$), ($1\leqslant m\leqslant 9$) (rel.), 50-250eV trapped-ion
71 E10	P.A.Redhead, Can. J. Phys. 49, 3059 (1971) Sequential impact mass spectroscopy: Estimates of metastable ion cross sections.	Ar^{n+}(meta., $1\leqslant n\leqslant 6$) : Ioniz. (rel.) 40-100eV trapped-ion
72 E1	R.U.Dalta, H.-J.Kunze and D.Petrini, Phys. Rev. A6, 38 (1972) Collisional rate coefficients for sodiumlike Ar VIII ions.	Ar^{7+}: Ioniz.rate & Exc. rate [3s→n=3, 4,5 states] Te, 62,260eV plasma
72 E2	W.Engelhardt, W.Koeppendoerfer and J.Sommer, Phys. Rev. A6, 1908 (1972) Measurement of the depopulation of the $2^3P_{0,1,2}$ levels of heliumlike ions by electron collisions.	C^{4+}, N^{5+}, O^{6+}, F^{7+},Ne^{8+} : Depopul. & Ioniz. rate; Te,160-215eV plasma
72 E3	R.K.Feeney, J.W.Hooper and M.T.Elford, Phys. Rev. A6, 1469 (1972) Absolute experimental cross sections for the ionization of singly charged barium ions by electron impact.	Ba^+: Ioniz. 10-1000eV crossed-beam
72 E4	J.B.Hasted and G.L.Awad, J. Phys. B: Atom. Molec. Phys. 5, 1719 (1972) Electron impact ionization of ions trapped in a hollow electron beam.	Ne^{n+}, N^{n+}, Ar^{n+}(n=1, 2,3): Ioniz. (rel.) T-500eV trapped-ion
72 E5	A.I.Imre, A.I.Dashchenko, I.P.Zapesochnyi and V.A.Kel'man, ZhETF Pis. Red. 15, 712 (1972); Sov. Phys. JETP Lett. 15, 503 (1972) Cross sections for the excitation of Ar II laser lines in electron-ion collisions.	Ar^+: Exc. [4s→4p] (rel.) T-35eV crossed-beam
72 E6	P.Mahadevan, Proc. Roy. Soc. A327, 317 (1972) Merging beams study of ionization od positive ions by electrons.	He^+, N^+, O^+: Ioniz. (rel.) up to 300eV merging-beam

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73 E1	J.N.Bradbury, T.E.Sharp, B.Mass and R.N.Varney, Nucl. Inst. & Methods 110, 75 (1973) Electron impact excitation and ionization of N^{4+}.	N^{4+}: Exc.[2s→2p] 125-400eV crossed-beam
73 E2	K.T.Dolder and B.Peart, J. Phys. B: Atom. Molec. Phys. 6, 2415 (1973) A measurement of cross sections for the 1s-2s excitation of He^+ ions by electron impact.	He^+: Exc.[1s→2s] 40-1000eV crossed-beam
73 E3	D.H.Crandall, P.O.Taylor and G.H.Dunn, 8th ICPEAC, p.330 (1973) Excitation of the $6^2P_{3/2}$ level of Ba II by electron impact and polarization of the emitted radiations.	Ba^+: Exc.[6^2S→6^2P] 2.72-750eV crossed-beam
73 E4	G.N.Haddad and R.W.P.McWhirter, J. Phys. B: Atom. Molec. Phys. 6, 715 (1973) Measurements of excitation rate coefficients for some Ne VIII lines.	Ne^{7+}: Exc.rate[2s→2p,3s,3p; 2p→3d] Te, 1.5,2.2x10^6K plasma
73 E5	J.B.Hasted, M.Hamdun and G.L.Awad, 8th ICPEAC, p.417 (1973) Ionization of positive ions by electrons in the hollow beam trap.	$2p^q$-ions: Ioniz. semi-empirical form.
73 E6	M.O.Pace and J.W.Hooper, Phys. Rev. A7, 2033 (1973) Absolute experimental cross section for the excitation of barium ions by electron impact.	Ba^+: Exc.[6^2S→6^2P] 2.5-98eV crossed-beam
73 E7	B.Peart, J.G.Stevenson and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 6, 146 (1973) Measurements of cross sections for the ionization of Ba^+ by energy resolved electrons.	Ba^+: Ioniz. 10-24eV, crossed-beam
73 E8	P.O.Taylor and G.H.Dunn, Phys. Rev. A8, 2304 (1973) Absolute cross sections and polarization for the K and H resonance lines of the Ca^+ ion.	Ca^+:Exc.[4^2S→$4^2P_{3/2}$, $4^2P_{1/2}$], 13-700eV & 3-335eV, resp. crossed-beam
74 E1	D.H.Crandall, P.O.Taylor and G.H.Dunn, Phys. Rev. A10, 141 (1974) Electron-impact excitation of the Ba^+ ion.	Ba^+:Exc.[6^2S→$6^2P_{3/2}$, $6^2P_{1/2}$; $6^2P_{3/2}$→7^2S, 6^2D], 2.5-747eV crossed-beam

74 E2	A.I.Dashchenko, I.P.Zapesochnyi and A.I.Irme, ZhETF Pis. Red. 19, 223 (1974); Sov. Phys. JETP Lett. 19, 137 (1975) Helium ion resonance line in electron-ion collisions.	He^+: Exc.[1s→2p] (rel.), T-300eV crossed-beam
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75 E1	D.H.Crandall, R.A.Phaneuf and G.H.Dunn, Phys. Rev. A11, 1223 (1975) Electron impact excitation of Hg^+.	Hg^+: Exc.[6^2S→ $6^2P_{3/2}$] 7.6-273.8eV crossed-beam
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75 E3	E.D.Donets and A.I.Pikin, Zh. Tekh. Fiz. 45, 2373 (1975); Sov. Phys. Tech. Phys. 20, 1477 (1976) Production of carbon and nitrogen nuclei and highly charged argon and xenon ions in an electron-beam ion source.	N^{n+}(n=3,5), Ar^{n+}(n=5,8,10,12), Xe^{n+}(n=10,15,20,24) : Ioniz. (rel.) 2.5keV trapped-ion
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75 E5	J.E.Hansen, J. Phys. B: Atom. Molec. Phys. 8, 2759 (1975) The structure of the autoionizing p^5ds configurations in Mg II, Ca II, Sr II and Ba II and interpretation of electron impact cross sections for these ions.	Ba^+, Sr^+, Ca^+, Mg^+: Ioniz. T-70eV crossed-beam

75 E6	A.I.Irme, V.A.Kel'man, A.I.Dashchenko and I.P.Zapesochnyi, Ukr. Fiz. Zh. 20, 1214 (1975) [Russian] Polarization and effective excitation cross sections for resonant radiation from Sr^+ ions subject to electron impact.	Sr^+: Exc.[5s→5p]
75 E7	V.A.Kel'man and A.I.Irme, Opt. Spektr. 38, 1226 (1975); Opt. Spectr. 38, 709 (1975) Absolute cross section for excitation of a Ca^+ ion resonance level by electron impact.	Ca^+: Exc.[4^2P→4^2D, 5^2S; 4^2S→4^2P] T-100eV crossed-beam
75 E8	V.A.Kel'man, A.I.Dashchenko, I.P.Zapesochnyi and A.I.Irme, Dokl. Akad. Nauk. 220, 65 (1975); Sov. Phys. Dokl. 20, 38 (1975) Effective cross section for MgII resonance doublet excitation in electron-ion collisions.	Mg^+: Exc.[3^2S→3^2P] 4.4-100eV crossed-beam
75 E9	B.Peart and K.T.Dolder, J. Phys. B: Atom. Molec. Phys. 8, 56 (1975) Measurements of cross sections for inner- and outer-shell ionization of Rb^+, Cs^+, Ca^+ and Sr^+ ions by electron impact.	Rb^+, Cs^+, Ca^+, Sr^+: Ioniz. up to 500, 400, 800,700eV, resp. crossed-beam
75 E10	W.E.Sayle, R.K.Feeney and T.F.Divine, 9th ICPEAC, p.895 (1975) Absolute experimental cross sections for the ionization of Cs^+ ions by electron impact.	Cs^+: Ioniz. T-2keV crossed-beam
75 E11	P.O.Taylor, R.A.Phaneuf, D.H.Crandall and G.H.Dunn, 9th ICPEAC, p.391 (1975) Electron impact excitation of positive ions: Absolute cross section.	Hg^+: Exc.[6^2S→$6^2P_{3/2}$] T-300eV crossed-beam
75 E12	I.P.Zapesochnyi, V.A.Kel'man, A.I.Irme, A.I.Dashchenko and V.S.Rohulitch, 9th ICPEAC, p.393 (1975) Excitation of the Mg^+ and Sr^+ ions in electron-ion collisions.	Exc. T-100eV Mg^+:[3s→3p;3p→4s] Sr^+:[5s→5p;5p→5d] crossed-beam
75 E13	I.P.Zapesochnyi, V.A.Kel'man, A.I.Irme, A.I.Dashchenko and F.F.Danch, JETP USSR 69, 1948 (1975); Sov. Phys. JETP 42, 989 (1976) Excitation of the Mg^+, Ca^+, Sr^+ and Ba^+ resonance levels in electron-ion collisions.	Exc. 2-100eV Mg^+[3s→3p;3p→4s] Ca^+[4s→4p;4p→4d,5s] Sr^+[5s→5p;5p→5d,6s] Ba^+[6s→6p;6p→6d,7s; 5d→4f] crossed-beam
76 E1	R.U.Dalta, L.J.Nugent and H.R.Griem, Phys. Rev. A14, 979 (1976) Ionization rate coefficients of multiply ionized atoms.	B^{3+}, C^{4+}: Ioniz.rate Te,220eV plasma

76 E2	T.F.Divine, R.F.Feeney, W.E.Sayle,II and J.W.Hooper, Phys. Rev. A13, 54 (1976) Absolute experimental cross section for the ionization of Tl^+ ions by electron impact.	Tl^+: Ioniz. T-2keV crossed-beam
76 E3	E.D.Donets and A.I.Pikin, JETP USSR 70, 2025 (1976); Sov. Phys. JETP 43, 1057 (1976) Ionization of positive argon ions by electron impact.	$Ar^{n+}(4\leqslant n\leqslant 12)$:Ioniz. (rel.)2.5±0.15 keV trapped-ion
76 E4	R.A.Phaneuf, P.O.Taylor and G.H.Dunn, Phys. Rev. A14, 2021 (1976) Absolute cross sections for emission of 284.7-nm (HgII) and 479.7-nm (HgIII) radiation in electron- mercury-ion collisions.	Hg^+: Exc.[6s→7s]; Exc.+Ioniz.[λ4797] T-300eV, T-90eV, resp. crossed-beam
77 E1	D.H.Crandall, P.O.Taylor and R.A.Phaneuf, 10th ICPEAC, p.1086 (1977) Electron impact ionization of C IV and N V.	C^{3+}, N^{4+}: Ioniz. T-500eV crossed-beam
77 E2	E.D.Donets and V.P.Ovsyannikov, 10th ICPEAC, p.1088 (1977) Ionization of nitrogen, oxygen, neon and argon positive ions by electron impact.	N^{n+}, O^{n+}, Ne^{n+}, Ar^{n+}: Ioniz. (rel.) trapped-ion
77 E3	J.B. Hasted, M.Hamdan and K.Birkinshaw, 10th ICPEAC, p.1082 (1977) Ionization of positive ions by electrons in the concentric beam equipment.	$C^{+,2+}$, $O^{+,2+}$; Ioniz. (rel.) 40-500eV trapped-ion
77 E4	L.A.Jones, E.Kaellne and D.B.Thomson, J. Phys. B: Atom. Molec. Phys. 10, 187 (1977) Measurements of the total collisional ionization rates of Ne VI, VII and VIII.	$Ne^{5+,6+,7+}$: Ioniz. rate, Te,120-400eV plasma
77 E5	E.Kaellne and L.A.Jones, J. Phys. B: Atom. Molec. Phys. 10, 3637 (1977) Measurements of the ionisation rates of lithium-like ions.	N^{4+}, O^{5+}: Ioniz. rate plasma
77 E6	P.O.Taylor, R.A.Phaneuf, D.Gregory, G.H.Dunn and D.H.Crandall, 10th ICPEAC, p.1100 (1977) Absolute cross sections for electron impact excitation of C^{3+}.	C^{3+}: Exc.[2s→2p] T-300eV crossed-beam
77 E7	P.O.Taylor, D.Gregory, G.H.Dunn, R.A.Phaneuf and D.H.Crandall, Phys. Rev. Lett. 39, 1256 (1977) Absolute cross sections for 2s-2p excitation of C^{3+} by electron impact.	C^{3+}: Exc.[2s→2p] 8.0-530eV crossed-beam
77 E8	W.E.Sayle,II and R.K.Feeney, 10th ICPEAC, p.1084 (1977) Absolute cross sections for electron impact double ionization of Na^+ ions.	Na^+: Ioniz.to Na^{3+} T-1000eV crossed-beam

ne

He^{+} (I): 61E1, 62E1, 67E5, 68E2, 69E9, 72E6
(E): 66E2, 67E1, 68E7, 73E2, 74E2, 74E3

Ne

Ne^{+} (I): 63E1, 64E1, 66E1, 67E5, 70E3, 72E4
(R): 66E3, 67E4

Ne^{2+} (I): 67E5, 70E3, 72E4
(R): 66E3, 67E4

Ne^{3+} (I): 67E5, 70E3, 72E4
(R): 66E3, 67E4

Ne^{4+} (I): 67E5, 70E3,
(R): 66E3, 67E4

Ne^{5+} (I): 67E5
(R): 66E3, 67E4, 77E4

Ne^{6+} (R): 66E3, 67E4, 71E3, 71E4, 71E8, 77E4

Ne^{7+} (R): 66E3, 67E4, 71E5, 71E6, 73E4, 77E4

Ne^{8+} (R): 72E2

Ar

Ar^{+} (I): 64E1, 66E1, 67E5, 70E3, 71E10, 72E4
(E): 72E5, 72E7

Ar^{2+} (I): 64E1, 67E5, 70E3, 71E10, 72E4

Ar^{3+} (I): 67E5, 70E3, 71E10, 72E4

Ar^{4+} (I): 67E5, 70E3, 71E10, 76E3

Ar^{5+} (I): 67E5, 70E3, 71E10, 75E3, 76E3

Ar^{6+} (I): 67E5, 71E10, 76E3

Ar^{7+} (I): 76E3
(R): 72E1

$Ar^{8+,10+,12+}$ (I): 75E3, 76E3

$Ar^{9+,11+}$ (I): 76E3

Kr

Kr^{+} (I): 63E3, 64E1, 65E1, 66E1, 67E5
(E): 72E7

Kr^{2+} (I): 64E1, 67E5
(E): 74E4

$Kr^{3+,\ 4+,5+,6+,7+}$ (I): 67E5

Xe

Xe^{+} (I): 63E3, 66E1, 67E5

Xe^{2+} (I): 64E1, 67E5

$Xe^{3+,4+,5+,6+,7+,8+,9+}$ (I): 67E5

Xe^{10+} (I): 67E5, 75E3

$Xe^{15+,\ 20+,\ 24+}$ (I): 75E3

B

B^{3+} (R): 76E1

C

C^{+} (I): 69E10, 71E2, 77E3

C^{2+} (I): 69E10, 77E3

C^{3+} (I): 69E10, 77E1
(E): 77E6, 77E7
(R): 71E4

C^{4+} (I): 69E10
(R): 68E1, 68E4, 72E2, 76E1

N

N^{+} (I): 63E2, 69E5, 72E4, 72E6

N^{2+} (I): 69E1, 71E2, 72E4

N^{3+} (I): 75E3
(R): 71E3

N4+ (I): 77E1
(E): 73E1
(R): 70E2, 71E4, 71E5, 77E5

N^{5+} (I): 75E3
(R); 72E2

O

O^{+} (I): 69E10, 71E1, 72E6, 77E3

O^{2+} (I): 69E10, 71E1, 77E3

O^{3+} (I): 69E10

O^{4+} (I): 69E10
(R): 71E3, 71E4

O^{5+} (I): 69E10
(R): 71E4, 71E5, 77E5

O^{6+} (I): 69E10
(R): 67E2, 72E2

F

F^{7+} (R): 72E2

Li

Li^+ (I): 66E4, 67E6, 67E7, 68E6, 69E6*, 69E7*, 69E9

Na

Na^+ (I): 66E5, 68E5, 77E8*

K

K^+ (I): 66E5, 68E5

Rb

Rb^+ (I): 75E9

Cs

Cs^+ (I): 67E3, 71E9, 75E9, 75E10

$Cs^{2+,3+,4+,5+,6+,7+,8+,9+}$ (I): 71E9

Mg

Mg^+ (I): 68E3, 75E5
(E): 75E8, 75E12, 75E13

Mg^{2+} (I): 69E6, 69E8

Ca

Ca^+ (I): 75E5, 75E9
(E): 71E7, 73E8, 75E7, 75E13
(R): 74E5

Sr

Sr^+ (I): 75E5, 75E9
(E): 75E6, 75E12, 75E13
(R): 70E1

Ba

Ba^+ (I): 68E6, 69E3, 71E9, 72E3, 73E7, 75E5
(E): 69E2, 69E4, 73E3, 73E6, 74E1, 75E13
(R): 70E1, 74E5

$Ba^{2+,3+,4+,5+,6+,7+,8+,9+}$ (I): 71E9

Hg

Hg^{+} (I): 63E3, 64E1, 68E8
(E): 75E1, 75E11, 76E4

Hg^{2+} (I): 64E1, 68E8
(E): 76E4

$Hg^{3+,4+,5+,6+,7+,8+,9+}$ (I): 68E8

Si

Si^{8+} (R): 71E3

Fe

$Fe^{7+,8+,9+}$ (R): 75E2

Tl

Tl^{+} (I): 76E2

(I): ionization
(E): excitation
(R): rate coefficient
* : double ionization

ELECTRON IMPACT EXCITATION AND IONIZATION OF POSITIVE ATOMIC IONS

(THEORETICAL)

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ABBREVIATIONS

METHODS OF APPROXIMATION

BEA	binary encounter approx.
BO	Born-Oppenheimer
CB	Coulomb-Born
CB'	Coulomb-Bethe
CBO	Coulomb-Born-Oppenheimer
CC	close-coupling
DW	distorted wave
ER	exact resonance
IP	impact parameter

PROCESSES

Exc	excitation
Ion	ionization

OTHERS

DCS	differential cross section
a.u.	atomic unit
E	incident energy
I	ionization energy
k	incident electron wave number in a.u.
Ry	Rydberg unit of energy (=13.6 eV)
X	incident energy in unit of I (for ION) or in unit of excitation energy (for Exc)
CI	configuration mixing
HF	Hartree Fock wave function

40 T1 M.H. Hebb and D.A. Menzel, Astrophys. J. 92, 408 (1940) — O III, Exc
Physical processes in gaseous nebulae. X.
[transitions between $^3P, ^1D, ^1S$; CB with exchange]

41 T1 S. Miyamoto, Mem. Coll. Sci. Kyoto Imperial Univ. A23, 467 (1941) — O III, Exc
On the excitation of O III-ion in $2p^2$-configuration by the electron impact.
[transitions between $^3P, ^1D, ^1S$; BO]

48 T1 L.H. Aller, Publ. Astr. Soc. Pacific 60, 317 (1948) — O II, Exc
The collisional excitation of the λ3727 radiation of O II.

50 T1 L.H. Aller, Astrophys. J. 111, 6-9 (1950) — N II, O II,III Exc
Target areas for the collisional excitation of nebular lines.
[upper limit to cross sections]

51 T1 E.R. Hill, Austral. J. Sci. Res. A4, 437 (1951) — Fe XIV, Exc, Ion
Collisional processes involving highly ionized atoms.
[$^2P_{3/2} \rightarrow {}^2P_{1/2}$ and Ion (X=1.5-6); DW]

53 T1 B.H. Bransden, A. Dalgarno and N.M. King, Proc. Phys. Soc. A66, 1097 (1953) — He II, Exc
The application of variational methods to scattering by ions, II: The distorted-wave approximation and the 1s-2s excitation of helium ions by electron impact.
[1s → 2s at 43.7, 48.7, 65.3 eV; DW]

53 T2 M.J. Seaton, Proc. Roy. Soc. A218, 400 (1953) — N II, O II,III, F II-IV, Ne III-V, Na IV,V, Mg V, S II, Exc
Electron excitation of forbidden lines occurring in gaseous nebulae.
[N II, O II,III, Ne III, S II: transitions between states of $2p^n$ or $3p^n$ configuration, calculated in ER with correction at X = 1; fine-structure transitions for O III; cross sections are also estimated for F II-IV, Ne III-V, Na IV,V, MgV]

54 T1 J. T. Jefferies, Austral. J. Phys. 7, 22 (1954) — Ca II, Exc
Some electron collision cross sections of Ca^+.
[4s $^2S_{1/2} \rightarrow$ 4p $^2P_{1/2,3/2}$ at 0.3 Ry; DW]

55 T1 M.J. Seaton, Proc. Roy. Soc. A231, 37 (1955) — O II,III, N II, F II-IV, Ne III-V, Na IV,V, Mg V, S II, Exc
Further calculations on electron excitation of forbidden lines: transitions with electric quadrupole moments.
[transitions between 2nd and 3rd states of the ground configuration at X = 1; DW calculation for O II,III, S II; interpolated for other ions]

55 T2 M.J. Seaton, The Airglow and the Aurorae, ed. by Armstrong and Dalgarno, p.289 (1955) — review, Exc
The calculation of cross-sections for excitation of forbidden atomic lines by electron impact.
[review of calculations and estimation of collision strengths by inter- or extrapla-tion for transitions among the levels arising from the same electron configuration $2p^n$ (n= 2 - 4) or $3p^3$; X = 1; for further details see 55 T3 and 58 T1]

55 T3 M.J. Seaton, Ann. d'Astrophys. 18, 188 (1955) — C II, Si II, Fe II, Exc
The kinetic temperature of the interstellar gas regions of neutral hydrogen.
[C II: 2p $^2P_{1/2} \rightarrow {}^2P_{3/2}$ at X =1; DW;
Si II 3p $^2P_{1/2} \rightarrow {}^2P_{3/2}$ and Fe II: a $^6D_{9/2} \rightarrow$ a $^6D_{7/2}$, a $^6D_{5/2}$; estimated]

57 T1 M.J. Seaton and D.E. Osterbrock, Astrophys. J. 125, 66 (1957) — O II, Exc
Relative [O II] intensities in gaseous nebulae.
[transitions between $^2P_{1/2,3/2}$, $^2D_{3/2,5/2}$, $^4S_{3/2}$; improved ER (exact resonance) method]

58 T1 M.J. Seaton, Rev. Mod. Phys. 30, 979 (1958) — review, N II,III, O II,III, F II-IV, Ne III-V, Na IV,V, Mg V, S II, Exc
Thermal inelastic collision processes.
[review of calculations and recommended values given for the collision strengths for transitions between states of $2p^n$(n=2 - 4) or $3p^3$ configuration]

59 T1 S.B. Schwartz and H. Zirin, Astrophys. J. 130, 384 (1959) — Fe XIV, Ion
Collisional ionization cross-section for Fe XIV in the solar corona and the coronal electron temperature.
[X = 1 - 14 and rate for 0.3 - 2.6 x 10^6K; DW; single electron (H-like) treatment]

60 T1 A. Burgess, Astrophys. J. 132, 503 (1960) — H-like ions, Ion
A note of the calculation of coronal ionization cross-sections.
[nuclear charge Z = 2, ∞; X = 1 - 6; CB]

60 T2 H. van Regemorter, Mon. Not. Roy. Astr. Soc. 121, 213 (1960) — Ca II, Exc
Electron impact excitation of positive ions: application to Ca^+ 4s-4p and 3d-4p.
[CB I,II, CB' I,II at 0 and 0.1 Ry above threshold]

60 T3 H. van Regemorter, Ann. d'Astrophys. 23, 817 (1960) — Mg II, Ca II, Exc
Méthodes de calcul des sections d'excitation par chocs électroniques.
[Ca II data taken from 60 T2; Mg II 3s → 3p : CB I,II, CB' I,II at 0 and 0.1 Ry above threshold]

61 T1 A. Burgess, Mem. Soc. Roy. Sci. Liége 4, 299 (1961) — H-like ions, Exc, Ion
New results on coronal cross-sections.
[Z = 2, ∞; X = 1-6 for both Ion and Exc(1s → 2p); CB]

61 T2 F.B. Malik and E. Trefftz, Z. Naturforschg. 16a, 583 (1961) — O V, Ion
Ionisationsquerschnitt von O V gegenüber Elektronenstoss unter teilweiser Berücksichtigung des Austauschs.
[9, 12, 20 Ry; DW with exchange partially taken account]

61 T3 L.A. Vainshtein, Opt. i Spektroskopiya 11, 301 (1961); Opt. & Spectry. 11, 163 (1961) — C V, VI, Exc
The excitation of atoms and ions by electron impact I. Calculation ignoring exchanges.
[C V(2s-3p), C VI(2s-3p); X =1-7.76; Born & DW]

61 T4 H. van Regemorter, Compt. Rend. Acad. Sci. 252, 2514 (1961) — Mg II, Exc
Section d'excitation par chocs électroniques du magnésium ionisé.
[3s⟶ 3p at final energy of 0, 0.1, 0.326 Ry; CB I, II, CB' I, II]

61 T5 H. van Regemorter, Compt. Rend. Acad. Sci. 252, 2667 (1961) — Ca II, Exc
L'excitation par choc de la transition 4s-3d de Ca^+.
[4s-3d at final energy of 0.1062, 0.2062 Ry; CB I, II (4s-4p coupling taken account), CB' I,II]

62 T1 O. Bely, Compt. Rend. Acad. Sci. 254, 3167 (1962) — Fe XIV, Exc
Calcul de quelques sections de choc dans Fe XIV.
[$^2P^o \longrightarrow {}^2D, {}^2S$ at X = 1; CB]

62 T2 O. Bely, Compt. Rend. Acad. Sci. 254, 3075 (1962) — O VI, Exc
Calcul de sections d'excitation par chocs électroniques dans O VI.
[2^2S-2^2P; 0.878-20 Ry; CB and CB']

62 T3 M. Blaha, Bull. Astr. Inst. Czech. 13, 81 (1962) — Fe XIV, Exc
Excitation of Fe XIV by electron collisions.
[$^2P_{1/2}$-$^2P_{3/2}$; DW with exchange]

62 T4 C.M. Varsavsky, Ioniz. Phenomena in Gases part 1, ed. by H. Maecker, p.69 (1962) — O VI, Exc
Excitation cross sections for highly ionized atoms.
[O VI; CB]

63 T1 O. Bely, J. Tully et H. van Regemorter, Ann. de Phys. 8, 303 (1963) — Be II, C IV, O VI, Mg II,X, Si IV, Fe XVI Exc
L'excitation des atomes par chocs électroniques. Application a l'excitation des transitions de résonance dans le séries isoelectroniques du lithium et du sodium.
[2s-2p or 3s-3p; X = 1-6; CB I,II and CB' I,II]

63 T2 A. Burgess and M.R.H. Rudge, Proc. Roy. Soc. A273, 372 (1963) — He II, Ion
The ionization of hydrogenic positive ions by electron impact.
[log X = 0-1.2; CB, CBO, CB-exchange]

63 T3 M.K. Gailitis, Tr. Inst. Fiz. Akad. Nauk Latv.SSR 13 (1963); Atomic Collisions, Butterworths, p.81 (1966) — H-like ions Z = 2, 3, 4, ∞ Exc
A Coulomb-Born approximation for s-s transitions.
[CB]

63 T4 M.K. Gailitis, Tr. Inst. Fiz. Akad. Nauk Latv.SSR 13 (1963); Atomic Collisions, Butterworths, p.87 (1966) — Exc
The use of the Bethe approximation in calculating the excitation cross-section of ions by electrons.
[$\Delta E/Z^2$ = 1/16 - ∞ ; X = 1-3; Bethe approx.]

63 T5 M.K. Gailitis, Opt. i Spektroskopiya 14, 465 (1963); Opt. & Spectry. 14, 249 (1963) — H-like ions Z = 2, 3, 4, ∞ Exc
Calculation of the excitation of ions by electron using Coulombic wave functions.
[1s-2s,3s; X = 1-3; CB compared with Born, DW, Bethe approx.]

63 T6 J.L. Kulander and C.B. Emmanuel, Phys. Fluids 6, 1656 (1963) — Fe XIV, Ion
Ionization of Fe XIV by electron impact.
[X = 1-14 (I = 390 eV); Bethe approx.]

63 T7 E. Trefftz, Proc. Roy. Soc. A271, 379 (1963) — OV, VI, Ion
The cross section for ionization of O^{5+} by electron impact.
[O V (a correction to the previous DW calculation and extension; O VI,CBO; X = 1-4]

63 T8 C.M. Varsavsky, Planet. Space Sci. 11, 1001 (1963) — O VI, Exc and Ion
Atomic parameters for five times ionized oxygen.
[2s-2p,3p,4p; X = 1-6 and Ion at X = 1.5, 2, 4 IP]

64 T1 P.G. Burke, D.D. McVicar and K. Smith, Atomic Collision Processes, p.339 (1964) — He II, Exc
The scattering of electrons by He^+.
[1s-2s,2p; 40.8-217.6 eV; CC]

64 T2 P.G. Burke, D.D. McVicar and K. Smith, Proc. Phys. Soc. 83, 397 (1964) — He II, Exc
The excitation of He^+ by electrons.
[1s-2s,2p; 44.2-217.6 eV; 1s-2s-2p CC with exhange]

64 T3	P.G. Burke, D.D. McVicar and K. Smith, Proc. Phys. 84, 749 (1964) Scattering of electrons by ionized helium. [1s-2s(DCS) at 4.0, 3.24, 6.0 Ry and 1s-3p at 3.65, 3.75, 3.85, 4.0, 5.0 Ry; CC]	He II, Exc
64 T4	S.J. Czyzak and T.K. Krueger, Atomic Collision Processes, ed. by McDowell, p.213 (1964) On the calculation of electron excitation cross sections for forbidden lines occurring in gaseous nebulae. [CB, ER, DW]	S III, Cl IV, Ar V, S II, Exc
64 T5	R. McCarroll, Proc. Phys. Soc. 83, 409 (1964) Electron scattering b y the helium positive ion in the 1s, 2s, or 2p state. [1s-2s,2p at k = 2.0, 2.2, 2.4, 2.6 a.u.; 1s-2s-2p CC with exchange]	He II, Exc
65 T1	P.G. Burke and A.J. Taylor, Proc. Roy. Soc. A287, 105 (1965) The ionization of H and He^+ by electron impact. [Ion from 1s or 2s; X = 1-4; 1s-2s-2p CC for initial state and Coulomb functions for outgoind electrons, also Born and BO]	He II, Ion
65 T2	L. Goldberg, A.K. Dupree and J.W. Allen, Ann. d' Astrophys. 28, 589 (1965) Collisional excitation of autoionizing levels. [Exc/Ion ratio, T = 10^4 - 2 x 10^7K; Bethe approx.]	O IV-VI, Fe XV,XVI Exc of AI levels
65 T3	T.K. Krueger and S.J. Czyzak, Mem. Roy. Astr. Soc. 69, 145 (1965) Atomic wave functions, collision cross-sections, and transition probabilities of Fe ions. [3s-3p, 3p-3d; X = 1, 1.5, 2, 4; CB I,II]	Fe XVI, Exc
65 T4	D. Petrini, Compt. Rend. Acad. Sci. 260, groupe 4, 4929 (1965) Physique theorique atomique - Excitation par chocs électroniques des transitions 4s→4p, 4s →3d, 3d→ 4p du Ca II et 6s→6p, 6s →5d, 5d→ 6p du Ba II. [at three values of X (between 1 - 12); CB I, II CB' I, II]	Ca II, Ba II Exc
65 T5	M.R.H. Rudge and S.B. Schwartz, Proc. Phys. Soc. 86, 773 (1965) The ionization of He^+ by electron impact. [X = 1-5; CBE (method of 63T2)]	He II, Ion

66 T1	O. Bely, Ann. d'Astrophys. 29, 131 (1966) Calcul des sections de choc dans les ions de la série isoelectronique du lithium. I. Transitions dipolaires du type 2s → np. [2s-np (n = 2 - 7); X = 1 - 7; CB I,II]	Be II, N V, Ne VIII, Exc
66 T2	O. Bely, Proc. Phys. Soc. 87, 1010 (1966) An evaluation of the exchange contribution in the scattering of electrons by positive ions. [$^3P - ^1D$; X = 1; Ochkur-Rudge approximation and its modifications, compared with ER]	N II, O III, S III Cl IV, Ar V Exc
66 T3	O. Bely, JILA Report No.89 (1966) Electron collisions with positive ions. [comparison of various approximations (CC, IP, CB I,II, CB' I,II, Coulomb-exchange, etc.]	review (lecture note) H-, Li-, B-, C-, Na-, Al-, Si-, K-like ions Exc
66 T4	O. Bely, JILA Report No.66 (1966); Nuovo Cimento 49, 66 (1967) On the exchange contribution in the scattering of electrons by atoms and positive ions. [Ochkur-Rudge approximation]	N II, O III, F IV Na VI, P II,X S III, Cl IV Ar V,XIII, K XIV Ca VII,XV, V X Cr XI, Mn XII Fe XIII, Ni XV Exc
66 T5	O. Bely, Proc. Phys. Soc. 88, 587 (1966) Excitation of lithium-like ions by electron impacts. [2s-np (n = 2 - 7); X = 1 - 10; CB also 2s-2p,7p for H-like ion (Z=∞);CB]	Be II, N V, Ne VIII Exc
66 T6	O. Bely and D. Petrini, Physics Letters 23, 442 (1966) The excitation cross section Q(4s→3d) in Ca II. [R-matrix below and above the 4p threshold; CB]	Ca II, Exc
66 T7	F. Bely, O. Bely and Vo Ky Lan, Ann. d'Astrophys. 29, 343 (1966) The excitation of the ground configuration of Fe XIII by electron impact. [transitions between $^3P_{0,1,2}, ^1D_2, ^1S_0$ at 0.01, 5, 10 Ry; CB]	Fe XIII, Exc
66 T8	P.G. Burke, J.H. Tait and B.A. Lewis, Proc. Phys. Soc. 87, 209 (1966) Excitation of N V by electron impact. [transitions between 2s, 2p, 3s, 3p, 3d; threshold to 435 eV; CB]	N V, Exc

66 T9 S.J. Czyzak and T.K. Krueger, Astrophys. J. 144, 381 (1966)
On the excited levels of Fe VIII.
[transitions between 3s, 3d, 4s, 4p, 4d, 4f, 5s, 5f, 6s, 6f, 7f, $3p^5 3d^2$; X = 1 - 4; CB]

Fe VIII, Exc

66 T10 I.C. Percival, Nuclear Fusion 6, 182 (1966)
Cross sections for collisions of electrons with hydrogen atoms and hydrogen-like ions.
[1s-n; empirical]

H-like ions
Exc

66 T11 M.R.H. Rudge and S.B. Schwartz, Proc. Phys. Soc. 88, 563 (1966)
The ionization of hydrogen and of hydrogenic positive ions by electron impact.
[from 1s, X = 1.125 - 5; from 2s, X = 1.25 - 6; Born II, Born-exchange, or angle dependent Coulomb potential method]

He II and H-like ion with Z=128
Ion

66 T12 M.R.H. Rudge and S.B. Schwartz, Proc. Phys. Soc. 88, 579 (1966)
The ionization of complex ions by electron impact : I.- Ionization cross section for Fe XV and Fe XVI.
[X = 1.25 - 5.0; Born II and Born-exchange]

Fe XV, XVI, Ion

66 T13 H.E. Saraph, M.J. Seaton and J. Shemming, Proc. Phys. Soc. 89, 27 (1966)
Electron collisions with ions in $2p^2$ configurations.
[transitions between $^3P, ^1D, ^1S$; ER, DW]

N II, O III, Ne V, Mg VII, S XI, Zn XXV
Exc

66 T14 D.P. Sural and N.C. Sil, Proc. Phys. Soc. 87, 201 (1966)
Excitation of helium-like ions by electron impact.
[$1^1S - 2^1S$; X = 1; CB]

Li II, Exc

67 T1 I.L. Beigman and L.A. Vainshtein, JETP USSR 52, 185 (1967); Sov. Phys. JETP 25, 119 (1967)
Effective cross sections for the exchange excitation of atoms and ions by electron impact.
[Li II, C V: $1s^2\ ^1S - 1s2s\ ^3S$; C III: $2s^2\ ^1S - 2s2p\ ^3P$; X = 1 - 47; a first-order theory with the use of the orthogonalized wave function]

Li II, C III,V
Exc

67 T2 I.L. Beigman, L.A. Vainshtein, A.V. Vinogradov, 5th ICPEAC, Abstracts of Papers, 438 (1967)
Double excitation of atoms by electron impact.
[$2s^2 - 2p^2$; X = 1 - 25; IP, 1st, 2nd perturbation theory and CC compared]

O V, Exc

67 T3 O. Bely, Nuovo Cimento 49, 66 (1967)
Exchange contribution in the scattering of electrons by atoms and positive ions.
C-, Si-like ions
Exc
see 66T4

67 T4 O. Bely, Nuovo Cimento 49, 87 (1967)
Potentials occurring in the excitation of highly ionized ions by electron impacts.
[$^3P_0 - {}^3P_2$, $^3P_2 - {}^1D_2$; 5 Ry; CB]
Fe XIII, Exc

67 T5 O. Bely and F. Bely, Solar Phys. 2, 285 (1967)
The excitation of Fe XVII by electron impacts.
[$2s^22p^6 \rightarrow 2s^22p^53s$, $2s^22p^53p$, $2s^22p^53d$, $2s2p^63s$, $2s2p^63p$, $232p^63d$; X = 1; CB]
Fe XVII, Exc

67 T6 S.J. Czyzak and T.K. Krueger, Proc. Phys. Soc. 90, 623 (1967)
Electron collisions with ions of the $3p^3$ configuration.
[transitions between $^4S, ^2D, ^2P$; at 0.005 Ry above ^2P threshold; improved DW; HF functions used]
S II, Cl III, Ca VI
Ar IV, K V, V IX,
Fe XII, Exc

67 T7 S.J. Czyzak, T.K. Krueger, H.E. Saraph and J. Shemming, Proc. Phys. Soc. 92, 1146 (1967)
Excitation of forbidden lines: Calculations for the $2p^3$, $2p^4$, $3p^2$ and $3p^4$ isoelectronic sequences.
[transitions between $^3P, ^1D, ^1S$ or between $^4S, ^2D$, ^2P; 0 or 0.005 Ry above ^1S or ^2P threshold, resp. ER, DW; HF functions used]
O II, F II,III
Ne III,IV, Na IV,V
Mg V,VI, P II
S III, Cl II,IV
Ar III,V,XI,XII
K IV,VI, Ca V,VII
V VIII,X, Cr IX,XI
Mn X,XII, Fe XI,
XIII, Ni XIII,XV
Al VI, Exc

67 T8 H.L. Kyle and K. Omidvar, 5th ICPEAC, Abstracts of Papers, 444 (1967)
Excitation and ionization of $He^+(1s)$ by electron impact.
[1s-2s for E $\leq$ 1000 eV; Ion from 1s for E $\leq$ 800 eV binary encounter approximation]
He II, Exc, Ion

67 T9 W. Lotz, Z. Physik 206, 205 (1967)
An empirical formula for the electron-impact ionization cross-section.
[an empirical formula with 3 adjustable parameters proposed for cross section]
He II, Li II, N II
Ne II, Na II, K II
Ion

67 T10 W. Lotz, Astrophys. J. Suppl. 14, 207 (1967)
Electron-impact ionization cross-section and ionization rate coefficients for atoms and ions.
[inter- or extrapolation of experimental data; up to 10^3 or 10^4 eV]
He II, Li II,III
Be II,III, B II,III
C II,III, N II,III
O II,III, F II,III
Ne II,III, Na II,
III, K II, Ion

67 T11 S. Ormonde, W. Whitaker and L. Lipsky, Phys. Rev. Letters 19, 1161 (1967) — He II, Exc
Close-coupling calculations of electron-impact excitation of the 2s state and autoionization below the n = 3 level in He^+.
[42-52 eV; CC]

67 T12 D. Petrini, Compt. Rend. Acad. Sci. Paris 264B, 411 (1967) — Fe XIV, Exc
Sections de choc de Fe XIV.
[$^2P^o_J \rightarrow {}^2S_{J'}, {}^2P_{J'}, {}^2D_{J'}, {}^2D'_{J'}$; X = 0; CB I; LS and intermediate coupling]

67 T13 S. Sato, K. Kobayashi and H. Takebe, Publ. Astron. Soc. Japan 19, 290 (1967) — Fe IX-XVI, Ion; see also 68T7
Collisional ionization cross-sections for Fe ions and the temperature of the solar corona.
[DW with exchange calculation for FeXIV, X = 1-16; approximate estimation for other ions]

67 T14 W. van Rensbergen, Bull. Astr. Inst. Netherlands 19, 6 (1967) — Si IX, Ion
Collisional excitation of auto-ionizing levels in the term system of Si IX at coronal temperatures.
[ratio of autoionization of doubly-excited levels to collisional ionization; log T = 5.7 - 8; Bethe]

68 T1 O. Bely, J. Phys. B(Proc. Phys. Soc.)1, 23 (1968) — Mg II, Al III P V, Ca X, Fe XVI Ion
The structure of the ionization curves of the sodium like ions.
[excitation of an inner (n=2) electron followed by autoionization; log X = 0 - 1.8; CB]

68 T2 O. Bely and M. Blaha, Solar Physics 3, 563 (1968) — Fe XV, Exc
Emission of Fe XV in coronal conditions.
[$^1S \rightarrow {}^1P, {}^1D$ at X = 1,2,3; $^1P \rightarrow {}^1D$ at X = 1,2; CB also $^1S_0 \rightarrow {}^3P_{0,1,2}$ at X = 1; Coulomb-exchange + nonexchange contribution]

68 T3 M. Blaha, Ann. d'Astrophys. 31, 311 (1968) — many ions with $2s, 2p^2, 2p^4, 2p^5$ $3s, 3p^2, 3p^4, 3p^5$ 2s2p, 3s3p configurations, Exc
Collision excitation of positive ions in p^q configuration: Transitions between levels of the p term. Part I.
[$^2P_{1/2} - {}^2P_{3/2}$ or $^3P_0 - {}^3P_2$; X = 1; CB, DW]

68 T4	P.G. Burke and D.L. Moores, J. Phys. (Proc. Phys. Soc.) B1, 575 (1968) Scattering of electrons by Mg^+ and Ca^+ ions. [Mg II: 3s→3p,3d, $E \leq 2$ Ry Ca II: 4s→4p,4d, $E \leq 1$ Ry; CC with and without exchange]	Mg II, Ca II Exc
68 T5	R.J.W. Henry and R.W. Williams, Publ. Astron. Soc. Pacific 80, 669 (1968) Collision strengths and photoionization cross sections for nitrogen, oxygen, and neon. [Ne III,V: tranisitions between $^3P, ^1D, ^1S$ Ne IV: transitions between $^4S, ^2D, ^2P$ at threshold energy for ^1S or ^2P, resp.; CC]	Ne III, IV, V Exc
68 T6	B.L. Moiseiwitsch and S.J. Smith, Rev. Mod. Phys. 40, 238 (1968) Electron impact excitation of atoms. [H-like ion (He II, $Z=\infty$): 1s-2s,2p Li-like ion (Be II, C IV, N V, O VI, Mg X): 2s-2p,3p; Na-like ion (Mg II, Si IV, Fe XVI): 3s-3p,3d; CB, CC, unitarized CB]	review H-,Li-,Na-like ions, Exc
68 T7	S. Sato, K. Takahashi and H. Takebe, Publ. Astron. Soc. Japan 20, 149 (1968) Collisional ionization cross-sections for Fe ions and the temperature of the solar corona. II. [re-estimation of cross section and rate coeff. cf.67 T13]	Fe IX-XVI, Ion
69 T1	O. Bely and S.B. Schwartz, Astron. Astrophys. 1, 281 (1969) Ionization of highly charged positive ions. [X = 1.25-4; rate coefficient for $T_e = 1 - 4 \times 10^6$K; CB; approximate sum rule and selectrion rule discussed]	Fe XIV, Ion
69 T2	M. Blaha, Astron. Astrophys. 1, 42 (1969) Collision excitation of positive ions in p^q configurations: Transitions between levels of the p term. Part II. [fine-structure transitions; X = 1; CB with exchange]	C II, N II,III O II-IV, F II-V Ne II-VI, Na III-VI, Mg IV-VI, Al V,VI, Si II,VI, IX,X, P II,III S II-IV,X,XII Cl II-V, Ar II-VI,X-XIV, K III-VII, Ca IV-VI, XII-XV, Sc V-VII Ti VI,X,XIV,XV Fe X-XIV, Ni XII-XV, Zn XIV,XV

69 T3 M. Blaha, Astrophys. J. 157, 473 (1969)
Effective Gaunt factors g_{eff} for excitation of positive ions by electron collisions in a simplified Coulomb-Born approximation.
[collision strengths for 2s-2p of Be II, C IV, N V, O VI; 3s-3p of Si IV, Fe XVI; 4s-4p of Ca II, Fe VIII; 3p-3d of Fe XVI; 3d-4p of Ca II; X = 1; CB I,II, simplified CB I,II also, effective Gaunt factor given for many s-p or p-d type single-electron excitations for some Z/k values between 2 and 16]

Li-,Be-,B-,C-,N-, O-,F-,Na-,Mg-,Al-, Si-,P-,S-,Cl-like ions, Exc

69 T4 P.G. Burke and A.J. Taylor, J. Phys. B(Atom. Mol. Phys.) 2, 44 (1969)
The excitation of He^+ by electron impact.
[1s-2s,2p; 3-4 Ry; CC]

He II, Exc

69 T5 D.G. Economides and M.R.C.McDowell, J. Phys. B(Atom. Mol. Phys.) 2, 1323 (1969)
Born cross sections for the ionization of He and Li^+ by electron impact.
[83 eV- 9keV; Born (without Coulomb distortion)]

Li II, Ion

69 T6 W. Eissner, H. Nussbaumer, H.E. Saraph and M .J. Seaton, J. Phys. B(Atom. Mol. Phys.) 2, 341 (1969)
Resonances in cross sections for excitation of forbidden lines in O^{2+}.
[variational principle used to calculate R matrix near resonances for transitions between $^3P,^1D,^1S$]

O III, Exc

69 T7 R.J.W. Henry, P.G. Burke and A.-L.Sinfailam, Phys. Rev. 178, 218 (1969)
Scattering of electrons by C, N, O, N^+, O^+ and O^{++}.
[transitions between $^3P,^1D,^1S$ for N II, O III; transitions between $^4S,^2D,^2P$ for O II; 0 - 10 eV; CC with exchange; HF functions used for target]

O II,III, N II Exc

69 T8 W. Lotz, Z. Physik 220, 466 (1969)
Electron-impact ionization cross-sections and ionization rate coefficients for atoms and ions from scandium to zinc.
[empirical formula given]

Ca II, Sc II,III
Ti II-IV, V II-IV
Cr II-IV, Mn II-IV
Fe II-IV, Co II-IV
Ni II-IV, Cu II-IV
Zn II-IV, Ga II-IV
Ion

69 T9 K.C. Mathur, A.N. Tripathi and S.K. Joshi, Phys. Rev. 184, 242 (1969)
Electron-impact ionization cross section of ions.
[up to 550 eV; classical impulse approximation]

Li II, Na II, K II
Cs II, Rb II, Mg II, Ne II, N II
Ion

69 T10 P. de A.P. Martins and M.J. Seatons, J. Phys. B (Atom. Mol. Phys.) 2, 333 (1969)
Quantum defect theory VIII. Resonances in the collision strengths for O^+ $2p^3$ $^2D_{3/2}$-$^2D_{5/2}$.
[R matrix from 69T15 extrapolated to obtain resonances below ^2P threhold]
O II, Exc

69 T11 P. de A.P. Martins, H.E. Saraph and M .J. Seaton, J. Phys. B(Atom. Mol. Phys.) 2, 427 (1969)
Electron impact transitions between fine structure levels in ions with configurations $1s^2 2s^2 2p^3$.
[transitions between $^4S_{3/2}$, $^2D_{3/2}$, $^2D_{5/2}$, $^2P_{1/2}$, $^2P_{3/2}$; R matrix from 69 T15 extrapolated to oftain cross section at lower energies]
O II, F III
Ne IV, Na V
Exc

69 T12 D.L. Moores and H. Nussbaumer, 6th ICPEAC, Abstracts of Papers, 17 (1969)
The ionization of positive ions by electron impact.
[Li II: threshold to 3000 eV; Mg II: threshold to 150 eV; CB without exchange]
Li II, Mg II
Ion

69 T13 D. Petrini, Astron. Astrophys. 1, 139 (1969)
The excitation cross-sections in Fe XIV.
[transitions between $^2P^o$, ^2D, $^2D'$, ^2P, ^2S; CC compared with CB; CI in the target wave function taken account]
Fe XIV, Exc

69 T14 D.H. Sampson, Astrophys. J. 155, 575 (1969)
Comparison of some recently proposed excitation and ionization rates.
[comparison of some empirical formulae]
He II, Ion

69 T15 H.E. Saraph, M.J. Seaton and J. Shemming, Phil. Trans. Roy. Soc. 264, 77 (1969)
Excitation of forbidden lines in gaseous nebulae. I. Formulation and calculations for $2p^q$ ions.
[transitions between ^3P, ^1D, ^1S or between ^4S, ^2D, ^2P or between fine-structure levels; ER, DW; Hartree-Fock functions used for ions]
C II, N II,III
O II-IV, F II-V
Ne II-VI, Na III-V
Mg IV-VII, Al V,VI
Si VI, Exc

69 T16 B.K. Thomas and J.D. Garcia, Phys. Rev. 179, 94 (1969)
Ionization of positive ions.
[classical BEA modified to take account of the Coulomb attraction by the ion; below 1000 eV]
He II, Li II, N II
Ne II, Na II, K II
Ion

70 T1 O. Bely and D. Petrini, Astron. & Astrophys. 6, 318 (1970)
Excitation of lithium-like ions by electron impacts. III. Transitions 2p → ns, 2p → np and 2p → nd.
[X=1, 1.5, 2; CB]

Be II, N V
Ne VIII, Exc

70 T2 A. Burgess, D.G. Hummer and J.A. Tully, Phil. Trans. Roy. Soc. A266, 225 (1970)
Electron impact excitation of positive ion.
[H-like ions: transitions between 1s, 2s, $2p_{1/2}$, $2p_{3/2}$; 0.75 - 4 Ry in the ground-state channel; He-like ion: 1^1S-2^3P,2^3S and transitions between 2^3P,2^1P,2^3S,2^1S; 0 - 4 Ry; CB I,II, CBO I,II]

He II, H-like ion with Z = ∞ and He-like ion with Z = ∞
Exc

70 T3 M.J. Conneely, K. Smith and L. Lipsky, J. Phys. B (Atom. Mol. Phys.) 3, 493 (1970)
Continuum processes involving atomic systems with configurations $1s^2...3p^q$.
[P II, Cl II: transitions between ^3P,^1D,^1S; for other ions: transitions between ^4S,^2D,^2P; CC]

P II, S II
Cl II,III, Ar IV
Exc

70 T4 S.J. Czyzak, T.K. Kruger, P. de A.P. Martins, H.E. Saraph and M.J. Seaton, Mon. Not. Roy. Astr. Soc. 148, 361 (1970)
Collision strengths for transitions in ions with configurations $3p^3$.
[transitions between $^4S_{3/2}$, $^2D_{3/2,5/2}$, $^2P_{1/2,3/2}$; CC; Hartree-Fock wave functions used for ions]

S II, Cl III, Ar IV, K V, Ca VI V IX, Cr X, Mn XI Fe XII
Exc

70 T5 J. Davis and S. Morin, Can. J. Phys. 48, 275 (1970)
Excitation of singly ionized barium ions by electron impact.
[$6^2S_{1/2}$ - $6^2P_{1/2,3/2}$; 3 - 100 eV; Burgess' semiclassical method]

Ba II, Exc

70 T6 J. Davis and S. Morin, J. Quantat. Spectrosc. Radiat. Transfer 10, 357 (1970)
[ns-np, np-nd (n = 5 - 7), 7d-7f; collision strengths, also inelastic Stark widths for several UV lines, rate at 15000, 20000, 30000K; Burgess' semiclassical theory]

N V, Exc

70 T7 J. Davis and S. Morin, J. Chem. Phys. 52, 4410 (1970)
Electron excitation cross sections for some N V multiplets.
[excitation of multiplets: λ3161 (5p-6s), λ4335 (6s-7p), λ5273 (6p-7s), λ4751 (6p-7d); 4-100 eV; IP]

N V, Exc

70 T8 J. Davis and S. Morin, Astrophys. J. 159, 1125 (1970)
De-excitation of singly ionized barium ions by electrons.
[$5^2D_{5/2}$-$6^2P_{3/2}$, $5^2D_{3/2}$-$6^2P_{1/2,3/2}$; 0.5-30 eV; IP]

Ba II, Exc

70 T9 M. Golshani, Phys. Rev. A2, 2340 (1970)
Excitation of highly ionized atoms by electron impact.
[3s-3p, 3p-3d; 20-120 a.u.; modified CB]

Fe XVI, Co XVII
Ni XVIII, Cu XIX
Exc

70 T10 Y-K. Kim and M. Inokuti, Phys. Rev. A1, 1132 (1970)
Total cross sections for inelastic scattering of charged particles by atoms and molecules. IV. Positive lithium ion.
[asymptotic form of cross section (for fast collision) estimated as a difference between total inelastic and excitation cross sections]

Li II, Ion

70 T11 T.K. Krueger and S.J. Czyzak, Proc. Roy. Soc. A318 531 (1970)
Excitation of forbidden lines in gaseous nebulae.
II. Calculations for $3p^q$ ions.
[transitions between states within the ground configuration $3s^2 3p^q$ (q = 1 to 5); at three different energies; DW]

P II,III, S II-IV, Cl II-V, Ar II-VI, K III-VII
Ca IV-VIII
V V,VIII-XI
Cr VIII-XII
Mn IX-XIII
Fe X-XIV, Co XI
Ni XII-XIV, Exc

70 T12 J.L. Kulander, J. Quant. Spectry. Radiat. Transfer 10, 299 (1970)
A comparison of electron impact ionization rates for N and O ions.
[kT_e = 1 - 1000 eV; Lotz (empirical), Garcia, Thomas-Garcia (69T16), Thomson (classical), Allen (Astronomical Quantities 2nd ed.), House (Ap.J. suppl. 81, 307) compared.]

N II-VII, O II-VIII, Ion

70 T13 K.C. Mathur, A.N. Tripathi and S.K. Joshi, J. Mass Spectrometry and Ion Phys. 4, 483 (1970)
Electron impact ionization of singly and doubly charged ions.
[Thomas-Garcia (69T16) method; threshold to 1 keV]

Ar II, Kr II, Xe II, Ba II, Sr II Sn II, Ag II, Zn II, Cd II, Hg II Ar III, Kr III Xe III, Hg III
Ion

70 T14 D.L. Moores and H. Nussbaumer, J. Phys. B (Atom. Mol. Phys.) 3, 161 (1970)
The ionization of Li^+ and Mg^+ by electron impact.
[Li II: 85 eV-25 keV; Mg II: 22 eV- 2 keV; CB without exchange]

Li II, Mg II
Ion

70 T15 H. Nussbaumer and D.E. Osterbrock, Astrophys. J. 161, 811 (1970)
On the forbidden iron emission lines in Seyfert galaxies.
[Fe VII: transitions between $^3F, ^1D, ^3P, ^1G$; DW
Fe X,XIX: $^2P_{1/2} - {}^2P_{3/2}$; estimated using f_{ij}]

Fe VII, X, XIX
Exc

70 T16 D.E. Osterbrock, J. Phys. B (Atom. Mol. Phys.) 3, 149 (1970)
Excitation of semi-forbidden $2s^2\ ^3P$ lines observed in quasars and nebulae.
[$2s^2\ ^1S$-$2s2p\ ^3P, ^1P$; CC]

B II, C III, N IV O V, Ne VII, Exc

70 T17 D. Petrini, Astron. Astrophys. 9, 392 (1970)
The electron excitation rate of the green coronal line 5303 A.
[$^2P_J{}^o \rightarrow {}^2S_{J'}, {}^2D_{J'}, {}^2P_{J'}, {}^2D'_{J'}$; CC, CB]

Fe XIV, Exc

70 T18 D.E. Roberts, J. Phys. B (Atom. Mol. Phys.) 3, 676 (1970)
Electron excitation and emission of the resonance lines of Si II.
[all allowed resonance transitions between $3s3p^2\ ^2D, ^2S$, $3s^24s\ ^2S$, $3s^23d\ ^2D$; X = 1 - 4; semi-classical perturbation]

Si II, Exc

70 T19 H.E. Saraph, J. Phys. B (Atom. Mol. Phys.) 3, 952 (1970)
Excitation of Ca^+ by electron impact: polarization of line radiation and transitions between fine-structure levels.
[some transitions between $4s\ ^2S$, $3d\ ^2D_{3/2,5/2}$, $4p\ ^2P_{1/2,3/2}$; R-matrix calculated by Burke and Moores (68T4) used]

Ca II, Exc

71 T1 O. Bely, S.B. Schwartz and J.L. Val, J. Phys. B (Atom. Mol. Phys.) 4, 1482 (1971) — Ba II, Ion
Autoionization structure in the ionization of Ba^+ by electron impact.
[10-110 eV; direct plus autoionization; based on Rudge-Schwartz formulation (66T12)]

71 T2 M. Blaha, Solar Physics 17, 99 (1971) — Fe XIV, Exc
Theoretical intensities of Fe XIV in the solar EUV spectrum.
[excitation of 45 states; analytic approximation of collision strengths; CB]

71 T3 J. Davis and S. Morin, J. Quant. Spectry. Radiat. Transfer 11, 463 (1971)
Threshold behavior of free-free Gaunt factor for atoms and ions.

71 T4 J. Davis and S. Morin, J. Quant. Spectry. Radiat. Transfer 11, 495 (1971) — Al III, Exc
Relevant atomic parameters for doubly-ionized aluminum.
[excitation of first 4 multiplets; 5-30 eV; IP (formulation by Burgess 64T6)]

71 T5 D.R. Flower, J. Phys. B (Atom. Mol. Phys.) 4, 697 (1971) — N V, Si XII Fe XIII-XV,XVII Exc
Collision strengths for electron excitation of highly ionized, complex atoms.
[N V, SI XII: transitions between $1s^2 2s, 2p, 3s, 3p, 3d$; Fe XIII: transitions between $3s^2 3p^2$, $3s 3p^3$, $3s^2 3p 3d$; Fe XIV: transitions between $3s^2 3p$, $3s 3p^2$, $3s^2 3d$; Fe XV: transitions between $3s^2$, $3s 3p$, $3p^2$, $3s 3d$; Fe XVII: transitions between $2p^6$, $2p^5 3s$, $3p 3d$; at a few incident energies, DW]

71 T6 D.R. Flower and C. Jordan, Astron. Astrophys. 14, 473 (1971) — Fe XV, Exc
On the identification of the λ417 line in the solar extreme ultraviolet spectrum.
[transitions between $3s^2\ ^1S$, $3s3p\ ^3P_{0,1,2}$, $3s3p\ ^1P$ at 3.1 Ry (relative to the ground state); excitation $3s^2\ ^1S \rightarrow 3s3p\ ^3P, ^1P$, $3p^2\ ^1D, ^3P, ^1P$, $3s3d\ ^3D, ^1D$ at 6.9 Ry; DW]

71 T7 L.B. Golden and D.H. Sampson, Astrophys. J. 170, 181 (1971) — H-like ions, Exc
Electron-impact cross-sections and rates for $n\ell \rightarrow n'\ell'$ transitions in hydrogenic ions and hydrogen.
[He II: $2\ell \rightarrow 3\ell'$, X = 1 - 7; HeII and H-like ion with Z = ∞: $1s \rightarrow 3\ell'$, X = 1 - 4; He II, Li III, B V, H-like ion with Z = ∞ : $1s \rightarrow 2\ell'$, X = 1; semiempirical cross section derived; CB]

71 T8 A. Jacobs, J. Quant, Spectrosc. Radiat. Transfer 11, 143 (1971) — H-like ions, Exc
Coulomb-Born excitation cross-sections of hydrogen-like ions by electron impact at threshold.
[H-like ion (Z=∞): $1s \rightarrow n\ell$ ($n \leqq 7$), $2s,2p \rightarrow n\ell$ (n = 3 - 7), $3s,3p,3d \rightarrow n\ell$ (n=4 - 7) at X-1; CBO and CB + Bely's exchange approximation]

71 T9 Yong-Ki Kim and M. Inokuti, Phys. Rev. A3, 665 (1971) — Li II, H-like ions, Ion
Total cross sections for inelastic scattering of charged particles by atoms and molecules. V. Evaluation to the next order beyond the Bethe asymptote.
[Li II and H-like ions: asymptotic form of ionization cross section; Born (Bethe + correction)]

71 T10 K.C. Mathur, A.N. Tripathi and S.K. Joshi, Astrophys. J. 165, 425 (1971) — Be II, B III, C IV, N V, O VI, F VII, Ne VIII, Al III, P V, Ca X, Fe XVI, Ion
Cross-sections and reaction rates for electron-impact ionization of lithiumlike and sodiumlike positive ions.
[Cross section for threshold to 1000 eV; rate for kT_e = 1 - 9000 eV; classical BEA]

71 T11 S. Ormond, K. Smith, B.W. Torres and M.J. Conneely 7th ICPEAC, Abstracts of Papers p.735 (1971) — N II, Exc
Electron impact excitation cross sections in atmospheric atoms and ions.
[transitions between $^3P,^1D,^1S$; preliminary result; final result → 73T9]

71 T12 G. Peach, J. Phys. B(Atom. Molec. Phys.) 4, 1670 (1971) — Li II, Na II, Mg II, III, K II, Ion
Ionization of atoms and positive ions by electron and proton impact.
[$\log_{10}(E/I)$ = 0 - 2.0; Born]

71 T13 I.C. Percival and D. Richards, J. Phys. B(Atom. Molec. Phys.) 4, 932 (1971) — H-like ions, Exc
Excitation of highly excited hydrogenic ions and atoms by charged particles III.
[transitions between highly excited states; sudden approximation for close collisions and first-order perturbation method for distant collisions; IP]

71 T14 A.R.P. Rau, Phys. Rev. A4, 207 (1971)
Two electrons in an Coulomb potential. Double-continuum wave functions and threshold law for electron-atom ionization.
[threshold law]

H-like ions
Ion

71 T15 D.H. Sampson and L.B. Golden, Astrophys. J. 170, 169 (1971)
Semiempirical cross-sections and rates for excitation and for ionization of hydrogenic ions by electron impact.
[n=1 → 2, 3; 2 → 3; and ionization;CB I,II, CBO, CC compared; X = 1 - 10; semiempirical formulae given]

He II, H-like ion with Z = ∞
Exc, Ion

71 T16 D.N. Tripathi and D.K. Rai, J. Chem. Phys. 55, 1268 (1971)
Cross section for double ionization by electron impact: Li^+, Na^+, K^+.
[double ionization; 80 eV-10 keV; Gryzinski-semiclassical]

Li II, Na II, K II
double Ion

71 T17 D.N. Tripathi and D.K. Rai, J. Quant. Spectrosc. Radiat. Transfer 11, 1665 (1971)
Cross sections for ionization of ions by electron impact.
[various classical and empirical methods; up to 10^4 eV]

He II, N II, Ne II
Na II, K II
Ion

72 T1 O. Bely and P. Faucher, Astron. & Astrophys. 18, 487 (1972)
A universal function for ionization of atoms, ions and molecules by structureless charged particles of arbitrary mass and charge.
[semiempirical formula derived, based on classical impulse approximation and experimental results]

Ion

72 T2 M. Blaha, Astron. & Astrophys. 16, 437 (1972)
Excitation of Mg^+ by electron collisions.
[transitions between ns(n=3,4,5,6), np(n=3,4,5), nd(n=3,4,5); up to 1.6 Ry; unitarized CB]

Mg II, Exc

72 T3 R.U. Datla, H.-J. Kunze and D. Petrini, Phys. Rev. A6, 38 (1972)
Collisional-rate coefficients for sodiumlike Ar VIII ions.
[$3\ell \rightarrow n\ell'$ (ℓ=3,p,d, n=3,4,5, ℓ'=s,p,d,f); 10 - 300 eV; CB]

Ar VIII, Exc

72 T4 D.R. Flower and J.M. Launay, J. Phys. B (Atom. Mol. Phys.) 5, L207 (1972)
On the validity of the distorted wave method in electron-atom collision theory.
[$2s^2\ ^1S$ - $2s2p\ ^1P, ^3P$, $2p^2\ ^3P, ^1D, ^1S$; 2.0 & 2.5 Ry. DW compared with CC]

C III, Exc

72 T5 A. Jacobs, J. Quantit. Spectrosc. Radiative Transfer 12, 243 (1972)
Analytical expressions for excitation and ionization cross-sections and rate coefficients of hydrogen-like ions by electron and proton impact.
[analytical formulae based on Born-Bethe approximation]

H-like ions
Exc, Ion

72 T6 A.R.G. Jackson, J. Phys. B(Atom. Mol. Phys.) 5, L83 (1972)
Excitation of a C II line observed in quasars.
[$(2s^2 2p + 2p^3)\ ^3P$ - $2s2p^2\ ^4P$; 0.35 - 0.75 Ry; CC]

C II, Exc

72 T7 S. Kastner, T.S. Smith, C. Wade and M. Blaha, J. Phys. B (Atom. Mol. Phys.) 5, 1351 (1972)
Electron excitation cross sections for Si XII.
[2s-np; 2p-nd; 3s-np; 4s-3d; CB; and 2s-ns, np, nd; Born (n = 2, 3, 4, or 7); X = 1 - 10]

Si XII, Exc

72 T8 R. Mew, Astron. & Astrophys. 20, 215 (1972)
Interpolation formulae for the electron impact excitation of ions in the H-, He-, Li- and Ne-sequences.
[four parameter empirical formulae for many transitions from the ground state]

H-, He-, Li-, Ne-sequences, Exc

72 T9 D.L. Moores, J. Phys. B (Atom. Mol. Phys.) 5, 286 (1972)
Electron impact ionization of positive ions with configuration $1s^2 2s^2 2p^q$.
[CB without exchange; X = 1.5 - 100]

C II, N II,III, O II, III, Ne II Na II, III, Mg III, Ion

72 T10 K. Omidvar, H.L. Kyle and E.C. Sullivan, Phys. Rev. A5, 1174 (1972)
Ionization of multielectron atoms by fast charged particles.
[10^2-10^5 eV; Born]

Li II, Ion

72 T11 A.D. Parks and D.H. Sampson, Astrophys. J. 178, 571 (1972)
Coulomb-Born-Oppenheimer cross-sections for excitation of hydrogenic ions of infinite Z by electron impact.
[1s,2s,2p - 3s,3p,3d; X = 1, 1.5; CBO]

H-like ion with Z = ∞, Exc

72 T12 D. Petrini, Astron. & Astrophys. 17, 410 (1972) — Be II, C IV, O VI, Ne VIII, Mg X, and Li-like ions for 1/Z = 0 ∿ 0.5, Exc

Electron excitation for the 2s → nf transitions in lithium-like ions.

[2s-4ℓ,5ℓ,6ℓ(ℓ= 0 ∿ 3) at X =1 for 1/Z=0 ∿ 0.5; Be II, ..., Mg X: 2s → 4f,5f,6f at X = 1, 2, 3; Ne VIII: 2s → 4s,4p,4d,4f,5s,5p,5d,5f at X = 1 ∿ 4; CB]

72 T13 E. Stingl, J. Phys. B (Atom. Mol. Phys.) 5, 1160 (1972) — C II, N III, O IV Ion

The ionization of boron and the isoelectronic ions carbon II, nitrogen III, and oxygen IV by electron impact.

[incident energy below 22, 40, 70 Ry, resp. modified CB and CB-exchange]

73 T1 H.S. Brandi and G.F. Koster, Phys. Rev. A8, 1303 (1973) — Ar II, Exc

Parametrization of the cross section for low-energy electron-atom scattering.

[from $^2P_{3/2}$ to various states in the configuration of $3p^4 4p$; 2 - 5 Ry; DW]

73 T2 D.R. Flower and J.M. Launay, Astron. & Astrophys. 29, 321 (1973) — C III, Exc

Electron collisional excitation of C^{+2}.

[$2s^2\ ^1S$ - $2s2p\ ^3P,^1P$, $2p^2\ ^3P,^1D,^1S$; 1.5, 2.0, and 2.5 Ry.; DW and CC]

73 T3 D.R. Flower and G. Pineau des Forets, Astron. & Astrophys. 24, 181 (1973) — Fe XIII, Exc; see also 74T6

Excitation of the Fe XIII spectrum in the solar corona.

[transitions between $3s^2 3p^2 (^3P_{0,1,2}, ^1D, ^1S)$, $3s3p^3$, $3s^2 3p3d$ states ; DW]

73 T4 M.D. Hershkowitz and M.J. Seaton, J. Phys. B (Atom. Mol. Phys.) 6, 1176 (1973) — C III, O V, Exc

The calculation of resonances in electron-ion scattering using the distorted wave approximation.

[$2s^2\ ^1S$ - $2s2p\ ^3P$; R matrix determined by variational method using approximate radial functions; up to 2 Ry.]

73 T5 A.R.G. Jackson, J. Phys. B (Atom. Mol. Phys.) 6, 2325 (1973) — N II,III, O III Exc

Excitation of semi-forbidden $2s^2 2p^2\ ^3P$-$2s2p^3\ ^5S^o$ and $2s^2 2p\ ^2P^o$-$2s2p^2\ ^4P$ lines observed in quasars.

[0.4-1 Ry; CC]

73 T6 S.P. Khare and U. Tarain, Proc. Indian Nat. Sci. Acad. 39A, 414 (1973) — He II, Ion
Total ionization cross sections of He^+ ions due to electron impact.
[68 eV-10 keV; semiempirical]

73 T7 M.R.C.McDowell, L.A. Morgan and V.P. Myerscough, 8th ICPEAC, Abstracts of Papers, 294 (1973) — He II, Exc
Distorted wave polarized orbital calculations of excitation of one electron system by electron impact.
[1s-2s; 3-20 Ry; polarized orbital DW]

73 T8 M.R.C. McDowell, L.A. Morgan and P. Myerscough, J. Phys. B(Atom. Mol. Phys.) 6, 1435 (1973) — He II, Exc
Electron impact excitation of H and He^+: I. 1s → ns transitions.
[1s → ns (n=2,3,4,5); differential and integral cross sections; up to 20 Ry; polarized orbital DW]

73 T9 S. Ormonde, K. Smith, B.W. Torres and A.R. Davies, Phys. Rev. A8, 262 (1973) — N II,IV, O II,III Exc
Configuration-interaction effects in the scattering of electrons by atoms and ions of nitrogen and oxygen.
[N II: $^3P \rightarrow {}^3D$; N IV: $2s^2\ {}^1S$-$2s2p\ {}^{1,3}P$ and between $2s^2\ {}^1S$, $2s3p\ {}^1P$, $2s3p\ {}^3P$; O II: ^4S-$2s2p^4\ {}^4P$; O III: ^3P-$2s2p^3\ {}^3S, {}^1P$; CC]

73 T10 B.N. Roy and D.K. Rai, J. Phys. B(Atom. Mol. Phys.) 6, 816 (1973) — Li II, double Ion
Application of classical collision theory to electron impact double ionization of atoms.
[double ionization; 0.3-2 keV; classical]

73 T11 A. Salop, Phys. Rev. A8, 3032 (1973) — Kr II-XXXVI, Ion (including autoionization)
Multi-ionization of krypton and its ions by high-energy electron impact.
[asymptotic form of the Bethe-Born matrix elements; numerical results given at 20 MeV]

73 T12 J.A. Tully, D. Petrini and O. Bely, Astron. & Astrophys. 23, 15 (1973) — Ca II, Exc
Anomalous electron impact excitation of Ca^+.
[4s-ns,np,nd,nf (n = 5 - 10); CB]

73 T13 R.J. Tweed, J. Phys. B(Atom. Mol. Phys.)6, 270(1973) — Li II, double Ion
Double ionization by electron impact: II. Calculations of cross sections for H^-, He and Li^+.
[up to 2.5 keV; Born; section I(general theory) at p.259]

73 T14 J.A. Tully, Canad. J. Phys. 15, 2047 (1973)
Collisional excitation of ground state hydrogenic ions.
[1s → ns, np, nd (n = 2 ∿ 6, ∞); X = 1, 2, 3, 4; simple formula for interpolation; CB]
He II, Be IV
O VIII
H-like ions with Z = ∞
Exc

74 T1 K.E. Banyard and G.K. Taylor, Phys. Rev. A10, 1019 (1974)
Generalized oscillator strengths for the $(1s^2 2s^2)\ ^1S \rightarrow (1s^2 2s2p)\ ^1P$ transition in some Be-like ions.
[for momentum change K = 0 - 3.5 a.u.; Born]
B II, C III, N IV
O V
Exc

74 T2 A. Burgess and V.B. Sheorey, J. Phys. B (Atom. Mol. Phys.) 7, 2403 (1974)
Electron impact excitation of the resonance lines of alkali-like positive ions.
[ns → np (n = 3, 4, 5, 6 for the four ions, resp.; X = 1 - 300; CB', CB, CDW]
Mg II, Ca II
Sr II, Ba II
Exc

74 T3 D.H. Crandall, G.H. Dunn, A. Gallagher, D.G. Hummer, C.V. Kunasz, D. Leep and P.O. Taylor, Astrophys. J. 191, 789 (1974)
Rate coefficients for electron excitation of the first resonance transition in H, Li, Na, Ca, Ca^+ and Ba^+ calculated from experimental data.
[CaII: $4s\ ^2S \rightarrow 4p\ ^2P$; Ba II: $6s\ ^2S \rightarrow 6p\ ^2P_{1/2,3/2}$ analytic approximation of experimental data → calculation of excitation and de-excitation rates; $T = 10^3 \sim 10^5$K]
Ca II, Ba II
Exc

74 T4 J. Davis, J. Quantit. Spectrosc. Radiat. Transfer 14, 549 (1974)
Effective Gaunt factors for electron impact excitation of multiply-charged nitrogen and oxygen ions.
[for a few transitions in each ion; g-factor given for X = 1 - 6; also averaged g-factor as a function of ΔE/kT; IP]
O II-VI, N II-V
Exc

74 T5 W. Eissner and M.J. Seaton, J. Phys. B (Atom. Mol. Phys.) 7, 2533 (1974)
Electron impact excitation of metastable levels in O^{2+}.
[transitions between ^3P, ^1D, ^1S; below 0.5 Ry; CC]
O III, Exc

74 T6 D.R. Flower and H. Nussbaumer, Astron. & Astrophys. 31, 353 (1974)
On the extreme ultraviolet emission spectrum of Fe XIII.
[transitions between $3s^2 3p^2$, $3s3p^3$, $3s^2 3p3d$; also correction to 73T3]
Fe XIII, Exc

74 T7 R.J.W. Henry, J. Phys. B(Atom. Mol. Phys.)7, L439 (1974)
Excitation of N V by electron impact.
[2s → 3s,3p,3d; 6Ry; various versions of CC]

N V, Exc

74 T8 M. Jones, Mon. Not. Roy. Astr. Soc. 169, 211 (1974)
Collision strengths for the electron impact excitation of certain highly-ionized helium-like ions.
[transitions between $1^1S,2^1S,2^3S,2^1P,2^3P_j$; both LS and intermediate coupling; DW and CB']

Si XIII, Ca XIX
Fe XXV
Exc

74 T9 M.R.C. McDowell, V.P. Myerscough and U. Narain, J. Phys. B (Atom. Mol. Phys.) 7, L195 (1974)
Electron impact on H and He^+: II. Coupling effect in the distorted wave polarized orbital approximation.
[1s → 2s; 0.75 ∿ 1 Ry; DWPO]

He II, Exc

74 T10 E. Oran and J. Davis, J. Appl. Phys. 45, 2480 (1974)
Electron impact cross-sections and rates for one- and two-electron aluminum ions.
[Al XII:1s,2s → np (n = 2 ∿ 5); 3s → 3p,4p,5p; 4s → 4p,5p; 5s → 5p; 2p → 3s,4s,5s; 3p → 4s,5s; 4p → 5s; Al III:1s → 2∿5p; 2s → 3p,4p, 5p; 3s → 4p,5p; 4s → 5p; X = 1 ∿ 8; IP]

Al XII, XIII
Exc

74 T11 A.K. Pradhan, J. Phys. B (Atom. Mol. Phys.)7, L503 (1974)
Electron impact excitation of Ne^{2+}.
[transitions between $^3P,^1D,^1S$; collision strengths for 0 - 0.8 Ry; rate constant for 5000 - 20000 K; CC]

Ne III, Exc

74 T12 A. Salop, Phys. Rev. A9, 2496 (1974)
Multi-ionization of neon, argon, and xenon and their ions by high-energy-electron impact.
[ionization including multiple ionization and autoionization; Born-Bethe asymptotic formula calculated ; numerical result shown at 20 MeV]

Ne^{n+}, Ar^{n+}, Xe^{n+} (all n)
Ion

74 T13 D.H. Sampson and A.D. Parks, Astrophys. J. suppl. 28, 323 (1974)
Electron-impact excitation cross-sections for complex ions. II. Application to the isoelectronic series of helium and other light elements.
[general formulae for many transitions]

highly-ionized atoms (number of electrons:1 - 4)
Exc

74 T14 H.E. Saraph and M.J. Seaton, J. Phys. B (Atom. Mol. Phys.) 7, L36 (1974)
On the convergence of close-coupling expansions for electron impact excitation of N^+.
[$2s^22p^2\ ^3P - ^1D,^1S$; below 0.8 Ry; CC; $2s^22p^2$-$2p^4$ configuration interaction included]

N II, Exc

74 T15 J.A. Tully, J. Phys. B (Atom. Mol. Phys.) 7, 386 (1974)
Collisional excitation of He-like positive ions by electrons.
[excitation of n^1S, n^1P (n = 2 - 6); X = 1 - 3; CB]

Li II, Be III
O VII, He-like ion with Z = ∞
Exc

74 T16 J.A. Tully and D. Petrini, J. Phys. B (Atom. Mol. Phys.) 7, L231 (1974)
A comparison of the Born and Coulomb-Born approximations for electron impact excitation of positive ions.
[2s - 2p, 3p; X up to 8; Born, CB]

Be II, N V, Ne VIII
Li-like ion with Z = ∞
Exc

74 T17 J.A. Tully and J.M.P. Serrão, Astronom. & Astrophys. 33, 187 (1974)
Electron impact excitation of metastable helium-like ions.
[2^1S - n^1S,n^1P; 2^3S - n^3S,n^3P; X = 1, 2, 4, 8, ∞; CB]

Li II, Be III
O VII, He-like ion with Z = ∞
Exc

74 T18 D.W. Walker, J. Phys. B (Atom. Mol. Phys.) 7, 97 (1974)
Electron impact excitation of hydrogenic ions.
[1s - 2s,2p; X = 1.07, 1.33, 5.33; CB with relativistic wave functions]

He II, Mn XXV
Sn L, H-like ion with Z = 100
Exc

75 T1 A.W. Allen, M. Blaha, W.W. Jones, A. Sanchez and H.R. Griem, Phys. Rev. A11, 477 (1975)
Stark-broadening measurement and calculations for singly ionized aluminum line.
[broadening of λ4663; 5000-40000K; DW]

Ar II, Exc

75 T2 D. Banks, J. Phys. B (Atom. Mol. Phys.) 8, 588 (1975)
Exchange effects in ionization of hydrogenic ions by electron impact.
[scaled cross section vs X (=1 - 10); BEA based on Mott scattering formula]

H-like ions with Z/n = 0 ∿ ∞
Ion

75 T3 A.K. Bhatia, J.W. Cooper and A. Temkin, 9th ICPEAC Abstracts of Papers 398 (1975)
Comparison of distsorted wave and close-coupling results for helium-like positive ions.
[1^1S-2^1S; 5.9 and 13.4 Ry; DW, CC]

Li II, Exc

75 T4 S. Chandra and U. Nariain, J. Phys. B (Atom. Mol. Phys.) 8, 770 (1975)
Electron impact ionization cross sections of some members of the helium isoelectronic series.
[semiempirical; threshold to 30 keV]

Li II, B IV, O VII
Ne IX, Mg XI
Ion

75 T5 D.R. Flower and H. Nussbaumer, Astron. & Astrophys. 42, 265 (1975)
Relative intensities of solar emission lines of ions in the sodium isoelectronic sequence.
[transitions between $3s^2S_{1/2}$, $3p^2P_{1/2.3/2}$,$3d$ $^2D_{3/2,5/2}$; at 3 values of X]

Si IV, S VI
Ca X, Fe XVI
Exc

75 T6 M.A. Hayes, J. Phys. B (Atom. Mol. Phys.) 8, L8 (1975)
Calculated collision strengths for electron impact excitation of N V.
[2s - 2p,3s,3p,3d; at 6 Ry; 5 state CC]

N V; Exc

75 T7 T. Ishihara and J.C.Y. Chen, 9th ICPEAC, Abstracts of Papers, 79 (1975)
Eikonal approximation for scattering of charged particles by ions.
[1s-2s; 50 - 500 eV; Coulomb-Glauber; numerical error corrected in 75T8]

He II, Exc

75 T8 T. Ishihara and J.C.Y. Chen, J. Phys. B (Atom. Mol. Phys.) 8, L417 (1975)
Eikonal approximation for scattering of charged particles by ions.
[1s-2s; 50 - 500 eV; also DCS at 100, 200, 300 eV; Coulomb-Glauber]

He II, Exc

75 T9 T. Kato, C.E.N. Report CEA-R-4660 (Centre d'Etudes Nucléaires de Saclay) (1975)
Calcul du coefficient d'excitation par collision avec des electrons.
[comparison of Mewe(72T8)'s empirical formula with experimental data and other calculations]

C VI, N IV,VII
O V, Ne VII,X
Mg VIII,XII
Si VII-IX, S IX-XI, Ca XII-XV
Fe XIII-XXII
Ni XIX,XXI,XXII
XXIV , Exc

75 T10 M. Malinovsky, Astron. & Astrophys. 43, 101 (1975)
New calculations of atomic data concerning E.U.V. lines of O V.
[$2s^2\ ^1S$ - $2s2p\ ^1P,^3P$, $2s3p\ ^1P$; $2s2p\ ^3P$ - $2p^2\ ^3P$; $2s2p\ ^3P_J$ - $2s2p\ ^3P_{J'}$; up to 13 Ry; DW]

O V, Exc

75 T11 H.E. Mason, Mon. Not. Roy. Astr. Soc. 170, 651 (1975)
The excitation of several iron and calcium lines in the visible spectrum of the solar corona.
[Fe X: $3s^23p^5\ ^2P_{1/2,3/2}$ - $3s3p^6$,$3s^23p^43d$ states;
Fe XI: $3s^23p^4$ - $3s3p^5$, $3s^23p^33d$, $3p^6$ states;
Fe XIV: $3s^23p$ - $3s3p^2$, $3s^23d$ states;
Ca XII: $2s^22p^5$ - $2s^22p^43s$, $2s^22p^43d$, $2s2p^6$states;

Fe X,XI,XIV
Ca XII,XIII,XV
Exc

Ca XIII: $2s^2 2p^4$ - $2s2p^5$, $2p^6$ states;
Ca XV: $2s^2 2p^2$ - $2s2p^3$, $2p^4$ states; DW; at X = 1]

75 T12 M.R.C. McDowell, L.A. Morgan and V.P. Myerscough, J. Phys. B (Atom. Mol. Phys.) 8, 1053 (1975)
Electron impact excitation of H and He^+. III. 1s → np transitions.
[1s - 2p,3p,4p; up to 250 eV; DWPO]
He II, Exc

75 T13 H. Narumi and A. Tsuji, Prog. Theor. Phys. 53, 671 (1975)
Inelastic Coulomb scattering in the Glauber approximation.
[1s-2s,2p; 40-300 eV; also DCS for 1s-2s for He^+; 1s-2s; $Z^2 - 4Z^2$ Ry for H-like ion with Z = ∞ ; Glauber approximation]
He II, also H-like ion with Z = ∞
Exc

75 T14 A.D. Parks and D.H. Sampson, J. Phys. B (Atom. Mol. Phys.) 8, 774 (1975)
Inner-shell excitation of lithium-like ions by electron impact.
[general formulae for oscillator strengths for $1s^2 2s$ → $1s2s^2$, 1s2s2p, $1s2p^2$; CBO; configuration mixing ignored]
Li-like ions
Exc

75 T15 L.P. Presnyakov and A.M. Urnov, J. Phys. B (Atom. Mol. Phys.) 8, 1280 (1975)
Asymptotic approach to the theory of excitation of multiply-charged ions by electron impact.
[2s-3s and 2p-3s; Coulomb Green function; 1/Z expansion formulae; resonances near theshold]
O VI, Exc

75 T16 W.D. Robb, J. Phys. B (Atom. Mol. Phys.) 8, L46 (1975)
Close-coupling calculations for electron impact excitation of N^+.
[^3P-^1D, ^3P-^1S; up to 1.2 Ry; CC; R-matrix approach]
N II, Exc

75 T17 M.J. Seaton, Adv. Atom. Mol. Phys. 11, 83 (1975)
Electron impact excitation of positive ions.
[review of works on Exc, Ion, Recomb, and Line broadening; illustrative examples include H-, He-, Li-like ions and Ca^+, FeXIV, etc.]
review

75 T18 A.D. Stauffer and L.A. Morgan, J. Phys. B (Atom. Mol. Phys.) 8, 2172 (1975)
A generalization of the Coulomb-projected Born approximation.
[1s-2s; DCS at 100 eV; integral cross section at 1 - 100 eV; Coulomb-projected Born]
He II, Exc

75 T19 D.W. Walker, J. Phys. B (Atom. Mol. Phys.) 8, 760 (1975)
Electron impact excitation of hydrogenic ions. II.
[1s-2s,$2p_{1/2,3/2}$; X = 1.07, 5.33; also DCS for 1s-2s; X = 1.33 for Sn L and Z = 100; relativistic CB, CBO]
Mn XXV, Sn L
H-like ion with Z = 100
Exc

76 T1 L.G.J. Boesten, H.G.M. Heideman, T.F.M. Bonsen and D. Banks, J. Phys. B (Atom. Mol. Phys.) 9, L1 (1976)
Threshold effects in the ionization of He^+ by electron impact.
[energy and angular momentum distribution of two ejected electrons; near threshold; classical]
He II, Ion

76 T2 B.H. Bransden and C.J. Noble, J. Phys. B (Atom. Mol. Phys.) 9, 1507 (1976)
Electron impact excitation of atomic hydrogen and hydrogenic ions.
[1s-2s,2p; $25Z^2$ - $250Z^2$ eV; IP formulation of 2nd order potential method]
H-like ion, Exc

76 T3 S. Chandra, H.P. Mital and U. Narain, Physica B & C 83, 384 (1976)
Ionization cross sections and rate coefficients for atoms, ions and molecules.
C II, O II, K II
N III, O III
Ion

76 T4 W. Dankwort, E. Trefftz, Astron. & Astrophys. 47, 365 (1976)
Oscillator strengths and collision strengths in Si X.
[many transitions at threshold and 86, 172, 260 eV, and rate coefficient at 10^6, 2 x 10^6 and 3 x 10^6K; CB; multi-config. HF wave functions used]
Si X, Exc

76 T5 J. Davis, P.C. Kepple and M. Blaha, J. Quant. Spectrosc. Radiat. Transfer 16, 1043 (1976)
Electron impact excitation coefficients for laboratory and astrophysical plasmas.
[1 - 6 transitions for each ion; effective Gaunt factor vs energy and/or rate vs T_e; DW]
Ne VI,VII, Mg VIII, X, Ca IX, Si IX
Fe IX,XI,XIV,XV, XVII,XIX,XX,XXI, XXIII,XXV,
Ni XXV, Exc

76 T6 J. Davis and K.G. Whitney, J. Appl. Phys. 47, 1426 (1976)
Line emission in Al XI as an optical diagnostic in laser-heated plasmas.
[many transitions; X = 1 - 4; DW]
Al XI, Exc

76 T7 Y. Hahn, Phys. Rev. A13, 1326 (1976)
Inner-shell excitations and ionizations of atomic ions by high-energy electron impact.
[excitations at 10 keV and ionization (including autoionization) at 1, 5, 10 keV; Born,Bethe]

Ar VII,IX,XV,XVII
Exc, Ion

76 T8 R.J.W. Henry and J.J. Matese, Phys. Rev. A14, 1368 (1976)
Excitation of He^+ by electron impact.
[1s-2s,2p; 40-120 eV; 1s-2s-2p-3s-3p CC]

He II, Exc

76 T9 T. Kato, Astrophys. J. suppl. 30, 397 (1976)
Radiation from a hot, thin plasma from 1 to 250 Å.
[estimated from optical f-value using empirical formula for g-factor suggested by Mewe]

He II, C II-VI
N III-VII, O IV-VIII, Ne III-X
Mg III-XII
Si V-XIV, S VI-XVI, Ca VI-XX
Fe VIII-XXVI
Ni X-XXVII
Exc

76 T10 C. Mitra and N.C. Sil, Phys. Rev. A14, 1009 (1976)
Excitation of hydrogenlike ions by electron impact.
[1s-2s; X = 1, 2, 4, 10; CB, CBO]

He II, Li III
C VI, Ne X, Sn L
Exc

76 T11 S. Nakazaki, J. Phys. Soc. Japan 41, 2084 (1976)
Electron-impact excitation cross-sections for helium-like ions: C V, N VI, O VII and Ne IX.
[1^1S - 2^1P,3^1P; 2^3S-2^3P,3^3P; 2^3P-3^3S; up to 20 keV(excitation from ground state) or to 2 keV; CB]

C V, N VI, O VII
Ne IX
Exc

76 T12 A.D. Parks and D.H. Sampson, Astrophys. J. 209, 312 (1976)
Electron impact excitation cross sections for complex ions. III. Highly charged ions with three valence electrons.
[collision strengths approximately expressed in terms of scaled collision strengths for H- or He-like ions with Z = ∞]

highly-charged ions with three valence electrons
Exc

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Close-coupling calculations for electron collisions with O^+ and for bound states of neutral oxygen.
[transitions between ^4S, ^2D, ^2P and fine-structure transition $^2D_{5/2}$-$^2D_{3/2}$; CC]

O II, Exc

76 T14 A. Salop, Phys. Rev. A14, 2095 (1976) — C II-VI, N II-VII, O II-VIII Ne II-X, Ar V-XIII, Ion
Electron impact ionization of multicharged ions.
[BEA]

76 T15 W.L. van Wyngaarden and R.J.W. Henry, J. Phys. B (Atom. Mol. Phys.) 9, 1461 (1976) — N V, Exc
Excitation of N V by electron impact.
[(2s or 2p) - (2p,3s,3p, or 3d); 1 - 16 Ry; CC]

76 T16 W.L. van Wyngaarden and R.J.W. Henry, Canad. J. Phys. 54, 2019 (1976) — Ne VIII, Exc
Excitation of Ne VIII by electron impact.
[2s - 2p,3s,3p; 2p - 3s,3p,3d; at 14, 18, 30 Ry; 5-state CC and CB]

76 T17 C.A. Weatherford, J. Phys. B (Atom. Mol. Phys.) 9, L135 (1976) — He II, Exc
A calculation of the 1s-2s transition in He^+ induced by electron impact.
[1s-2s; DCS and integrated cross section; 3.0-3.3 Ry; DW]

77 T1 K.L. Baluja and M.R.C. McDowell, J. Phys. B (Atom. Mol. Phys.) 10, L673 (1977) — He II, Be IV C VI, O VIII Ne X, Si XIV Ca XX, Fe XXVI Exc
Electron impact excitation of Fe XXVI and other one-electron ions.
[1s - np (n=2 - 6) for Fe XXVI, X = 1 - 4; 1s - 2s for all the ions; X = 1 - 26.67; CBO]

77 T2 K.A. Berrington, P.G. Burke, P.L. Dufton and A.E. Kingston, J. Phys. B (Atom. Mol. Phys.) 10, 1465 (1977) — C III, O V Exc
Electron collisional excitation of C III and O V.
[$2s^2\ ^1S$ - $2s2p\ ^3P,^1P$; up to 10 Ry; R-matrix method]

77 T3 A.K. Bhatia and A. Temkin, J. Phys. B (Atom. Mol. Phys.) 10, 2893 (1977) — Li II, Be III B IV, C V, N VI O VII, F VIII Ne IX, Si XIII Ca XIX, Fe XXV Exc
A distorted-wave methodology for electron-ion impact excitation: calculation for two-electron ions.
[1^1S - $2^1S,^1P,^3S,^3P$; DW]

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Resonances in the electron impact excitation of C^{+3}.
[2s - 2p; 2.25 - 2.50 Ry; 2s-2p-3s-3p-3d CC with exchange, frozen core approximation for 1s; R matrix method]

77 T5 J. Callaway, J.N. Gau, R.J.W. Henry, D.H. Oza, Vo Ky Lan and M . LeDourneuf, Phys. Rev. 16, 2288 (1977)
Excitation of C^{3+} by electron impact.
[2s - 2p; threshold to 2.6 Ry; 5-state CC]
C IV, Exc

77 T6 D.R. Flower, Astron. & Astrophys. 54, 163 (1977)
Excitation of the Fe XII spectrum in the solar corona.
[within groundstate configuration ($3s^2 3p^3$) and from ground state to $3s3p^4$, $3s^2 3p^2 3d$ states; at 6.6 Ry above the ground state; calculated in LS coupling and then transformed into intermediate coupling scheme]
Fe XII, Exc

77 T7 D.R. Flower, Astron. & Astrophys. 56, 451 (1977)
Atomic data for the coronal ion Fe^{8+}.
[transitions between and within $3p^6$ and $3p^5 3d$; at 5.5 Ry relative to the ground state]
Fe IX, Exc

77 T8 J.N. Gau and R.J.W. Henry, Phys. Rev. A16, 986 (1977)
Excitation of lithiumlike ions by electron impact.
[2s - 2p,3s,3p,3d; 2p - 3s,3p,3d; X = 1 - 3; 5-state CC]
C IV, Ar XVI
Exc

77 T9 L.B. Golden and D.H. Sampson, J. Phys. B (Atom. Mol. Phys.) 10, 2229 (1977)
Ionisation of highly charged ions by electron impact.
[H-like ion with Z = ∞ at 1s,2s,2p state; asymptotic form of ionization cross section at high energy; also approximate estimation of cross section for He-,...,O-like ions for ionization from 1s,2s,2p orbitals]
H-,He-,Li-,Be-, B-,C-,N-,O-like ions
Ion

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Improved Bethe approximation for electron-ion impact ionization.
[Ar IV: from 3s,3p; k = 2 - 25 a.u.; Fe IX: from 3p; k = 5 - 30 a.u.; Bethe]
Ar IV, Fe IX
Ion

77 T11 Y. Hahn, Phys. Rev. Letters 39, 82 (1977)
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[direct + Auger ionization; k = 20 8- a.u.; Bethe]
Mo XXV
Ion

77 T12 M.A. Hayes and M.J. Seaton, J. Phys. B (Atom. Mol. Phys.) 10, L573 (1977)
Accuracy of the distorted-wave approximation for excitation of hydrogenic ions.
[1s-2s,2p; X = 1 - 4; DW and 3-state CC]
He II, Li III
C VI, Ne X
Exc

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Electron impact excitation of Be^+ : a benchmark study.
[2s-2p; cross section and polarization of radiation emitted; 4 - 990 eV; CB and CC]

Be II, Exc

77 T14 T. Kato, IPPJ-AM-2 (1977)
Ionization and excitation of ions by electron impact - Review of empirical formulae -.
[reliability and applicability of various empirical formulae discussed]

review
Exc, Ion

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The variable-phase method in multichannel electron-atom or electron-ion scattering.
[comparison between the "variable-phase method" and the ordinary approach for some selected values of incident energy]

C IV, N II
Exc

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Electron impact excitation of carbon and oxygen ions.
[theoretical values collected and compared; 63 transitions for C ions and 30 transitions for O ions; X up to 5, 10, 100, or 1000; CC, DW, CB, IP, hydrogenic-ion approximation, 2nd-order potential method]

C II-VI, O IV-VIII
Exc

77 T17 M.R.C. McDowell, L.A. Morgan, V.P. Myerscough and T. Scott, J. Phys. B (Atom. Mol. Phys.) 10, 2727 (1977)
Electron impact excitation of one- and two-electron positive ions.
[1s-2s,2p; $0.75Z^2$ - $20Z^2$ Ry for H-like ions; 1^1S-2^1S,2^1P; X = 1 - 10 for He-like ions; DWPO]

He II, Li II
Be III, B IV
C V,VI, N VI
O VII,VIII, F VIII
Ne IX,X, Si XIII
Ca XIX, Fe XXV
Exc

77 T18 S. Nakazaki and T. Hashino, J. Phys. Soc. Japan 43, 281 (1977)
Excitation of beryllium-like ions by electron impact.
[$2s^2\ ^1S$ - $2s2p\ ^1P$; threshold to 4 keV; CB; configuration mixing taken account]

C III, N IV
O V, Ne VII
Exc

77 T19 A.D. Parks and D.H. Sampson, Phys. Rev. A15, 1382 (1977)
Electron-impact excitation of highly charged berylliumlike ions with inclusion of configuration mixing.
[transitions between $2s^2\ ^1S$, $2p^2\ ^1S$, $2s2p\ ^1P$,^3P; up to 3.25 Z^2 Ry; excitation to $2\ell 3\ell'$ states; X = 1.0 and 1.5]

Be-like ios with Z = ∞
Exc

77 T20 M.S. Pindzola, Phys. Rev. A15, 2238 (1977) O III, Exc
Electron-impact excitation of O III in the distorted wave approximation.
[$^3P - {}^1D$; 2.5 - 30 eV; DW]

77 T21 D.H. Sampson, A.D. Parks and R.E.H. Clark, Phys. Rev. A15, 1393 (1977) Li-like ion with $Z = \infty$ Exc
Effects of configuration and parentage mixing on inner-shell excitation of highly charged lithium-like ions by electron impact.
[transitions from $1s^2 2s$ or $1s^2 2p$ to many states with $1s2\ell3\ell'$ configuration; X = 1, 1/5, 2, 2.25]

77 T22 B.R. Tambe, J. Phys. B (Atom. Mol. Phys.) 10, L249 (1977) C II, Exc
Electron-impact-induced fine-structure transitions in singly ionized carbon.
[$^2P_{1/2} - {}^2P_{3/2}$; 0.000633 - 0.2 Ry; also rate coefficient at 100 K; 8-state CC]

Addenda

64 T6	A. Burgess, Proc. Symposium on Atomic Collision Processes in Plasmas (Culham Laboratory Sept.14-16, 1964), AERE-R4818 (1964) Semi-classical theory of electron-atom collisions. [a combined "exchange-classical"-"impact-parameter" method proposed]	Ion
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75 T20	J. Davis, P.C. Kepple and B. Blaha, J. Quantit. Spectrosc. Radiat. Transfer 15, 1145 (1975) Distorted wave calculations for multiply charged nitrogen and oxygen. [O II: excitation of $2s2p^4$, $2p^23s$; N II, O III: exc. of $2s2p^3$; N III, O IV: exc. of $2s2p^2$; N IV, O V: exc. of 2s2p and 2s3p; N V, O VI: exc. of 2p, 3p; also N III: exc. of 3s; DW]	O II-VI, N II-V Exc

General reference

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[supplement 1 to the Atomic Data for Fusion (a bulletin from the Controlled Fusion Atomic Data Center of Oak Ridge National Laboratory and the National Bureau of Standards(March 1977)]

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Sc VII 69T2

V IX 67T6, 70T4, 70T11

Cr X 70T4, 70T11

Mn XI 70T4, 70T11

Fe XII 67T6, 69T2, 70T4, 70T11, 76T9, 77T6

Ni XIV 69T2, 70T11, 76T9

Ion

Ar IV 74T12, 77T10

Fe XII 67T13, 68T7

Kr XXII 73T11

Xe XXXX 74T12

S-like ions (N = 16)

Exc

Cl II 67T7, 68T3, 69T2, 70T3, 70T11

Ar III 67T7, 68T3, 69T2, 70T11

K IV 67T7, 68T3, 69T2, 70T11

Ca V 67T7, 68T3, 69T2, 70T11

Sc VI 68T3, 69T2

Ti VII 68T3

V VIII 67T7, 68T3, 70T11

Cr IX 67T7, 68T3, 70T11

Mn X 67T7, 68T3, 70T11

Fe XI 67T7, 68T3, 69T2, 70T11, 75T11, 76T5, 76T9

Co XII 68T3

Ni XIII 67T7, 68T3, 69T2, 70T11, 76T9

Cu XIV 68T3

Zn XV 68T3, 69T2

Ga XVI 68T3

Ion

Ar III 70T13, 74T12

Fe XI 67T13, 68T7

Kr XXI 73T11

Xe XXXIX 74T12

Cl-like ions (N = 17)

Exc

Ar II 68T3, 69T2, 70T11, 73T1, 75T1

K III 68T3, 69T2, 70T11

Ca IV 68T3, 69T2, 70T11

Sc V 68T3, 69T2

Ti VI 68T3, 69T2

V VII 68T3

Cr VIII 68T3, 70T11

Mn IX 68T3, 70T11

Fe X 68T3, 69T2, 70T11, 70T15, 75T11, 76T9

Co XI 68T3, 70T11

Ni XII 68T3, 69T2, 70T11, 76T9

Cu XIII 68T3

Zn XIV 68T3, 69T2

Ga XV 68T3

Ge XVI 68T3

Ion

Ar II 70T13, 74T12

Fe X 67T13, 68T7

Kr XX 73T11

Xe XXXVIII 74T12

Ar-liki ions (N = 18)

Exc

Fe IX 76T5, 76T9, 77T7

Ni XI 76T9

Ion

K II 67T9, 67T10, 69T9, 69T16, 71T12, 71T16, 71T17, 76T3

Fe IX 67T13, 68T7, 77T10

Kr XIX 73T11

Mo XXV 77T11

Xe XXXVII 74T12

K-like ions (N = 19)

Exc

Ca II 54T1, 60T2, 60T3, 61T5, 65T4, 66T6, 68T4, 69T3, 70T19, 73T12 74T2, 74T3

Sc III 70T11

V V 70T11

Fe VIII 66T9, 69T3, 76T9

Ni X 76T9

Ion

Ca II 69T8

Sc III 69T8

Ti IV 69T8

Kr XVIII 73T11

	Xe XXXVI	74T12
Ca-like ions (N = 20)		
Exc	Fe VII	70T15
Ion	Sc II	69T8
	Ti III	69T8
	V IV	69T8
	Kr XVII	73T11
	Xe XXXV	74T12
Sc-like ions (N = 21)		
Ion	Ti II	69T8
	V III	69T8
	Cr IV	69T8
	Kr XVI	73T11
	Xe XXXIV	74T12
Ti-like ions (N = 22)		
Ion	V II	69T8
	Cr III	69T8
	Mn IV	69T8
	Kr XV	73T11
	Xe XXXIII	74T12
V-like ions (N = 23)		
Ion	Cr II	69T8
	Mn III	69T8
	Fe IV	69T8
	Kr XIV	73T11
	Xe XXXII	74T12
Cr-like ions (N = 24)		
Ion	Mn II	69T8
	Fe III	69T8
	Co IV	69T8
	Kr XIII	73T11
	Xe XXXI	74T12
Mn-like ions (N = 25)		
Exc	Fe II	55T3
Ion	Fe II	69T8
	Co III	69T8
	Ni IV	69T8
	Kr XII	73T11
	Xe XXX	74T12
Fe-like ions (N = 26)		
Ion	Co II	69T8
	Ni III	69T8
	Cu IV	69T8
	Kr XI	73T11
	Xe XXIX	74T12
Co-like ions (N = 27)		
Ion	Ni II	69T8
	Cu III	69T8
	Zn IV	69T8
	Kr X	73T11
	Xe XXVIII	74T12
Ni-like ions (N = 28)		
Ion	Cu II	69T8
	Zn III	69T8
	Ga IV	69T8
	Kr IX	73T11
	Xe XXVII	74T12
Cu-like ions (N = 29)		
Ion	Zn II	69T8, 70T13
	Ga III	69T8
	Kr VIII	73T11
	Xe XXVI	74T12
Zn-like ions (N = 30)		
Ion	Ga II	69T8
	Kr VII	73T11
	Xe XXV	74T12
Ga-like ions (N = 31)		
Ion	Kr VI	73T11
	Xe XXIV	74T12
Ge-like ions (N = 32)		
Ion	Kr V	73T11
	Xe XXIII	74T12
As-like ions (N = 33)		
Ion	Kr IV	73T11
	Xe XXII	74T12

Se-like ions (N = 34)

Ion	Kr III	70T3, 73T11
	Xe XXI	74T12

Br-like ions (N = 35)

Ion	Kr II	70T13, 73T11
	Xe XX	74T12

Kr-like ions (N = 36)

Ion	Rb II	69T9
	Xe XIX	74T12

Rb-like ions (N = 37)

Exc	Sr II	74T2
Ion	Sr II	70T13
	Xe XVIII	74T12

Sr-like ions (N = 38)

Ion	Xe XVII	74T12

Y-like ions (N = 39)

Ion	Xe XVI	74T12

Zr-like ions (N = 40)

Ion	Xe XV	74T12

Nb-like ions (N = 41)

Ion	Xe XIV	74T12

Mo-like ions (N = 42)

Ion	Xe XIII	74T12

Tc-like ions (N = 43)

Ion	Xe XII	74T12

Ru-like ions (N = 44)

Ion	Xe XI	74T12

Rh-like ions (N = 45)

Ion	Xe X	74T12

Pd-like ions (N = 46)

Ion	Ag II	70T13
	Xe IX	74T12

Ag-like ions (N = 47)

Ion	Cd II	70T13
	Xe VIII	74T12

Cd-like ions (N = 48)

Ion	Xe VII	74T12

In-like ions (N = 49)

Ion	Sn II	70T13
	Xe VI	74T12

Sn-like ions (N = 50)

Ion	Xe V	74T12

Sb-like ions (N = 51)

Ion	Xe IV	74T12

Te-like ions (N = 52)

Ion	Xe III	70T13, 74T12

I-like ions (N = 53)

Ion	Xe II	70T13, 74T12

Xe-like ions (N = 54)

Ion	Cs II	69T9

Cs-like ions (N = 55)

Exc	Ba II	65T4, 70T5 70T8, 74T2 74T3
Ion	Ba II	70T13, 71T1

Pt-like ions (N = 78)

Ion	Hg III	70T13

Au-like ions (N = 79)

Ion	Hg II	70T13