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List of Symbols

Constants

$a_0 = \hbar/me^2$ Bohr radius
c Velocity of light
e Elementary charge
$\hbar = h/2\pi$ Planck's constant divided by 2π
m Mass of electron
$\mathrm{Ry} = me^4/2\hbar^2$ Rydberg unit of energy

Quantum numbers

j Electron angular momentum
J Atomic angular momentum
J_T Total angular momentum of a system including atom and outer (scattered) electron
l Electron orbital momentum
L Atomic orbital momentum
L_p Orbital momentum of atomic core (of parent ion)
L_T Total orbital momentum of a system including atom and scattered electron
m, M Magnetic quantum numbers
n Principal quantum number
s Electron spin momentum
S Atomic spin momentum
S_p Spin momentum of atomic core (of parent ion)
S_T Total spin momentum of a system including atom and scattered electron
λ Orbital momentum of outer (scattered) electron

Basic Notations

a_0 Set of quantum numbers for initial state of an atom
a, a_1 Set of quantum numbers for final state
A Fitting parameter for approximation of rate coefficients $\langle v\sigma\rangle$
A_{ij} Einstein coefficient for spontaneous emission (radiative transition probability) $[\mathrm{s}^{-1}]$
C Fitting parameter for approximation of cross sections σ
D Fitting parameter for analytical approximation of calculated cross sections and rate coefficients
DE Energy scaling parameter
E_a Energy of bound electron in state a
$\mathscr{E}_0, \mathscr{E}$ Initial and final energies of free electron
f_{ij} Oscillator strength
$f(\vartheta)$ Scattering amplitude
$F_\lambda, F^\gamma_{\gamma'}, F^\Gamma_{\Gamma'}$ Radial functions of scattered electron in various representations
$g(a)$ Statistical weight of level a
$G^{SL}_{S_p L_p} = (l^{n-1}[S_p L_p]lSL\}\ l^n SL)$ Coefficient of fractional parentage [see Ref. 1.1]
$G(\beta)$ Function of analytical approximation for rate coefficients $\langle v\sigma\rangle$
$\mathrm{G}_\Gamma(\boldsymbol{r}, \boldsymbol{r}')$ Green's function
$j_x(z)$ Spherical Bessel function
$\mathscr{H}(\beta)$ Holtsmark distribution function
$n^* = \sqrt{z^2\,\mathrm{Ry}/|E|}$ Effective principal quantum number
N Number density of particles $[\mathrm{cm}^{-3}]$
$P_l(\cos\vartheta)$ Legendre polynomials
$P_l, P_{nl}, P_{nl}(r) = rR_{nl}(r)$, where $R_{nl}(r)$ is radial function for bound electron
$\mathrm{P}\int$ Principal value of integral
Q, Q_κ Angular factor defining the dependence of cross sections on angular momenta for transitions with no change of spin
Q'', Q''_κ Angular factor for exchange cross sections
S, S_{ik} Scattering matrix
T Temperature in energy units
T_{ik} Transition matrix
$u = \mathscr{E}/\Delta E = (\mathscr{E}_0 - \Delta E)/\Delta E$ Electron energy in threshold units
v Velocity of particles
$\langle v\sigma\rangle$ Rate coefficient averaged over Maxwellian velocity distribution $[\mathrm{cm}^3\,\mathrm{s}^{-1}]$
$W_{a_0 a}$ Dimensionless transition probability, frequency of collisional transitions $[\mathrm{s}^{-1}]$

$W_a(c)$ Autoionization probability for atomic state c [s^{-1}]
z Charge of atomic core (of parent ion)
$Z = z - 1$ Charge of ion
$\mathscr{Z}$ Charge of nucleus
γ Line width (full width) in Chapter 7, set of quantum numbers for atomic term in Sect. 6.2
$\gamma = aM\,\lambda mm^3$ Set of quantum numbers for a system including atom and scattered electron
$\Gamma = a\lambda 1/2 L_T S_T$ Set of quantum numbers for a system including atom and scattered electron in representation of total momenta
Δ Line shift in Chapter 7
$\Delta E = E_i - E_k$ Energy difference for levels i and k
κ Multipole order
κ_d Rate coefficient of dielectronic recombination [$cm^3\,s^{-1}$]
κ_r Rate coefficient for three-body recombination [$cm^6\,s^{-1}$]
κ_v Rate coefficient of radiative recombination [$cm^3\,s^{-1}$]
O Solid angle
ρ Impact parameter, density matrix
$\rho_{s\sigma}$ Spherical components of density matrix
$\sigma_{a_0 a}, \sigma(a_0, a)$ Effective cross section
$\sigma(a_0\lambda_0, a\lambda)$ Partial cross section
φ Fitting parameter for approximation of cross sections
$\Phi(u)$ Functions of analytical approximation for cross sections
χ Fitting parameter for approximation of rate coefficients
$[j_1 j_2 \ldots j_n] = \sqrt{(2j_1+1)(2j_2+1)\ldots(2j_n+1)}$
$(m_1 m_2 | s\sigma)$ Klebsch-Gordan coefficients (abbreviated notation)
$\begin{pmatrix} j_1 j_2 j_3 \\ m_1 m_2 m_3 \end{pmatrix}$ Wigner's $3j$ symbol
$\begin{Bmatrix} a_1 a_2 a_3 \\ b_1 b_2 b_3 \end{Bmatrix}$ $6j$ symbol
$\begin{Bmatrix} a b c \\ d e f \\ p q r \end{Bmatrix}$ $9j$ symbol
$(a_0 \| T \| a)$ Reduced matrix element

Subject Index

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