Chapter 7

ERRATA TO 2ND PRINTING OF *ANGULAR MOMENTUM*

The following errata have been collected from many sources to which we express our sincere gratitude. Special thanks go to Melissa A. Hines, Alexei Buchachenko, Shan Tao Lai, Andrew J. Orr-Ewing, and Yo Fujimura who communicated numerous corrections.

pg. 10 In Eq. (1.57) for the expression for $Y_{2,\pm 1}(\theta, \phi)$ change 16π to 8π in the square root sign.

pg. 36 In Eq. (45) change $-$ sign to $+$ sign in front of $\frac{1}{b}(\frac{\pi}{2})$.

pg. 36 In Eq. (46) replace $f[b(x), y]$ by $f[x, b(x)]$ and replace $f[a(x), y]$ by $f[x, a(x)]$.

pg. 36 In the two lines below Eq. (46) replace b/k by $1/k$.

pg. 38 Replace twice k by κ in the expression in the line below Eq. (58).

pg. 39 In the ordinate of Fig. 5 replace $E_0 - E$ by $(E_0 - E)$.

pg. 43 In the third line below Eq. (2.1) replace Eq. (1.16) by Eq. (1.8).

pg. 66 In line 9 replace "total angular momentum" by "total orbital angular momentum."

pg. 90 In both Eq. (3.77) and Eq. (3.78) replace superscript † by superscript $*$, and replace $d^J_{MM'}(\theta)$ by $d^J_{M'M}(\theta)$.

pg. 91 In line 1 replace † by * and omit "transpose."

pg. 99 Fig. 3.6 is misdrawn; $\mathbf{J}_2$ should connect to $\mathbf{J}_1$ and $\mathbf{J}_3$.

pg. 99 In the second to last line on the page change "Figures 1.1, 1.2, 1.3, and 2.2" to read "Figures 1.1, 2.1, 2.2, and 2.3."

pg. 101 In the exponent of (-1) in Eq. (3.111) change $J_1 - M_1$ to $J_1 + M_1$.

pg. 101 In the exponent of (-1) in Eq. (3.112) change $J_1 - M_1'$ to $J_1 + M_1'$.

pg. 117 In the left side of Eq. (2) replace $P_{JM}(\theta)$ by $P_{JM}(\theta)\mathrm{d}\Omega$.

pg. 144 In Eq. (4.3) replace $\langle j_{12}\, j_3\, j \,|\, j_1\, j_{23}\, j' \rangle$ by $\langle j_{12}\, j_3\, j' \,|\, j_1\, j_{23}\, j \rangle$.

pg. 149 In the second row of the 9-j symbol appearing once in Eq. (4.21) and twice in Eq. (4.22) interchange j_3 and j_4.

pg. 152 Rewrite rules 1 and 2 to read:

1. To add an arrow pointing toward or to drop an arrow pointing away from a particular jm pair, multiply the diagram by $(-1)^{j+m}$ and change the sign of m in the diagram.

2. To add an arrow pointing away or drop an arrow pointing toward a particular jm pair, multiply the diagram by $(-1)^{j-m}$ and change the sign of m in the diagram.

pg. 164 In the graphical diagram at the bottom of the page omit the central line $j_{1234} = 0$ and its label and add two lines connecting the $+$ and $-$ nodes; label these lines by j_{12} and j_{34}.

pg. 167 In Eq. (4.58) in the graph in the first line at the top of the page change from $+$ to $-$ the node on the right and the node on the bottom. Then in the graph in the second line of this equation, change from $+$ to $-$ the node on the top and the central node. Finally, remove the phrase starting with "where . . ."

pg. 174 In Eq. (4.65) change $\mathbf{j_2}$ to $\mathbf{j}$.

pg. 174 In the first line below Eq. (4.67) change $\mathbf{j_{23}}$ to $|\mathbf{j_{23}}|$.

pg. 174 In Eq. (4.67) add a minus sign before

$$\frac{d}{dt}(\mathbf{j_{23}} \cdot \mathbf{j}).$$

pg. 174 In Eq. (4.69) change $(\mathbf{j_1} \times \mathbf{j})$ to $(\mathbf{j_{12}} \times \mathbf{j})$.

pg. 176 In Eq. (4.71) change j_9 to j_7 in the last 6-j symbol on the right side of this equation.

pg. 178 In the third line from the bottom, change (see Application 4) to (see Eq. (14) of Application 4).

pg. 179 In three lines below Eq. (5.8) change Eq. (5.9) to Eq. (5.8).

pg. 181 In the line below Eq. (5.14) insert the factor $(-1)^{k+j-j'}$ in front of $(2j+1)^{1/2}$.

pg. 183 In the second line of Eq. (5.25) replace $\langle 3 \,||\, L \,||\, 3\rangle$ by $\langle 3 \,||\, L^{(1)} \,||\, 3\rangle$.

pg. 187 In Eq. (5.38) change $\sum_{q'}$ to $\sum_{q',q'_1}$.

pg. 188 In Eq. (5.46) in the first and second lines replace $\sum_q$ by $\sum_{q,q'}$.

pg. 189 In the line above Eq. (5.50) replace Eq. (4.21) by Eq. (4.20).

pg. 190 In the last line of the first paragraph replace "the gradient of the electric field" by "the gradient of the gradient of the electric field."

pg. 194 In Eq. (5.67) add $+2j_1$ to the exponent of (-1).

pg. 194 In Eq. (5.69) add $\delta_{jj'}$ to the last line on the right side.

pg. 195 In Eq. (5.70) add on the right side $\delta_{jj'}$.

pg. 201 In Eq. (5.85) replace $\psi(\alpha_e J_e M_e; t = 0$ by $\psi(\alpha_e J_e; t = 0)$.

pg. 201 In Eqs. (5.86), (5.87), and (5.88) replace $\psi(\alpha_e J_e M_e; t)$ by $\psi(\alpha_e J_e; t)$.

pg. 204 In the last line of this page remove the parentheses about $\hat{\mathbf{e}}_a$ and $\hat{\mathbf{e}}_a^*$.

pg. 209 In Eq. (5.118) insert a minus sign before the right side.

pg. 209 In two lines below Eq. (5.118) insert a minus sign before $e(1,-1)$.

pg. 216 In Eq. (5.133) replace † by $*$.

pg. 217 In Eq. (5.134) and in Eq. (5.136) change † to $*$ twice in each equation.

pg. 222 In Eq. (13) second line from bottom of page change j' to j.

pg. 224 In right side of Eq. (17) change -1 to 1.

pg. 228 Below Eq. (23) it should read: In the general case our system is in a *mixed state* which is represented by a density operator ρ that is an incoherent superposition of a number of pure states $|\psi^{(i)}\rangle$ with statistical weights $W^{(i)}$.

$$\rho = \sum_i W^{(i)} \left|\psi^{(i)}\right\rangle \left\langle\psi^{(i)}\right| \tag{24}$$

where

$$\sum_i W^{(i)} = 1. \tag{25}$$

pg. 228 In the line below Eq. (25) change "in" to "In."

pg. 229 In Eq. (27) insert "$\langle JM|\,\rho\,|JM'\rangle =$" before the expression on the right side of this equation.

pg. 229 In the sixth line from the bottom of the page, change a_M to $a_M^{(i)}$.

pg. 230 Change the sentence in line 13 to read: A pure state represents a completely ordered ensemble, whereas the mixed state that is uniform is in a state of maximum disorder.

pg. 230 Change the sentence in line 17 to read: Then for a pure state $S = 0$, whereas for a state of maximum disorder $S = \ln(2J + 1)$.

pg. 232 Add "cosine of the" before "angle" in part J.

pg. 237 In the exponent of (-1) in Eqs. (62) and (63) change M' to M.

pg. 238 In Eqs. (67) and (69) insert 3 in front of $O_0^{(1)}(J_\mathrm{i})$ and after $A_0^{(2)}$ insert the factor

$$\left[\frac{5J_\mathrm{i}(J_\mathrm{i}+1)}{(2J_\mathrm{i}+3)(2J_\mathrm{i}-1)}\right].$$

pg. 238 In Eq. (68) change $=$ to $\propto$.

pg. 239 In the right side of Eq. (71) change $A_0^{(2)}(J_\mathrm{f})$ to $A_0^{(2)}(J_\mathrm{i})$.

pg. 239 In the right side of Eq. (72) it should read:

$$\left[1 - \frac{1}{(J_\mathrm{f}+1)^2}\right]^{1/2}.$$

pg. 239 In the right side of Eq. (73) change $(2J_\mathrm{f} + 3)$ to $(2J_\mathrm{f} + 1)$.

pg. 239 In the right side of Eq. (76) make it read: $\left[1 - \frac{1}{J_\mathrm{f}^2}\right]^{1/2}$.

pg. 239 In the right side of Eq. (77) change $(2J_\mathrm{f} - 1)$ to $(2J_\mathrm{f} + 1)$.

pg. 240 In the Eqs. (79) and (80) drop the subscript q on J and the subscript 0 on I.

pg. 240 In the right side of Eq. (81) insert the factor $[(2F' + 1)(2F + 1)]^{1/2}$ inside the summation sign.

pg. 241 In Eq. (84) add a minus sign in front of the factor $i(E_{F'} - E_F)t/\hbar$ that appears in the first and third lines of this equation.

pg. 250 In the fourth line of Eq. (22) add a minus sign in front of $(5)^{1/2}$.

pg. 271 Replace the paragraph starting with "Eq. (6.63) is …" by "Note that Eq. (6.58), (6.59), and (6.60) are valid for integer and half-integer J and K, whereas Eq. (6.63) holds true only for integral J and K."

pg. 280 In Eq. (6.99) insert i in front of $(E_j - E_k)$.

pg. 281 In line 2 change Eq. (6.97) to Eq. (6.98).

pg. 281 In Eq. (6.103) in the first line for $\langle j|\,\mathcal{G}_3\,|k\rangle$ change $(E_k - E_\alpha)$ to $(E_k - E_\beta)$.

pg. 282 In Eq. (6.105) in its first line, replace twice $\mathcal{H}_R$ by $\mathcal{H}_1$.

pg. 284 In Eq. (6.112) replace π by π^4.

pg. 285 Eq. (6.117) should read:

$$
\begin{aligned}
&S(J'K';J''K'') \\
&\quad= 3\sum_{M',M''}\left|\left[\left(\frac{2J'+1}{8\pi^2}\right)\left(\frac{2J''+1}{8\pi^2}\right)\right]^{1/2}\int D^{J'}_{M'K'}D^{1*}_{0K'-K''}D^{J''*}_{M''K''}\mathrm{d}\Omega\right|^2 \\
&\quad= 3\sum_{M',M''}\left|\frac{[(2J'+1)(2J''+1)]^{1/2}}{8\pi^2}\left[\int D^{J'*}_{M'K'}D^{1}_{0K'-K''}D^{J''}_{M''K''}\mathrm{d}\Omega\right]^*\right|^2 \\
&\quad= 3\sum_{M',M''}\left|\left(\frac{2J''+1}{2J'+1}\right)\langle J''M'',10|J'M'\rangle\,\langle J''K'',1K'-K''|J'M'\rangle\right|^2 \\
&\quad= 3\frac{2J''+1}{2J'+1}\langle J''K'',1K'-K''|J'K'\rangle^2\sum_{M',M''}\langle J''M'',10|J'M'\rangle^2 \\
&\quad= 3\frac{2J''+1}{2J'+1}\langle J''K'',1K'-K''|J'K'\rangle^2\sum_{M}\left(\frac{2J'+1}{3}\right)\langle J''M'',J'-M|10\rangle^2 \\
&\quad= (2J''+1)\,\langle J''K'',1K'-K'|J'K'\rangle^2 \\
&\quad= (2J'+1)(2J''+1)\begin{pmatrix} J'' & 1 & J' \\ K'' & K'-K'' & -K' \end{pmatrix}^2
\end{aligned}
$$

pg. 287 In Eq. (6.123) insert the phase factor $(-1)^{J'-1+K''}$ in front of the 3-j symbol inside the double summation.

pg. 294 In Eq. (6.142) change $\boldsymbol{\omega}$ to ω in the middle term.

pg. 297 In last line insert after rotation: for $M = J$.

pg. 298 In line 2 insert after rotation: for $M = J$.

pg. 303 Change Eq. (34) to read:

$$|\psi(F_2)\rangle = a_J \left|{}^2\Pi_{\frac{3}{2}} vJ\right\rangle - b_J \left|{}^2\Pi_{\frac{1}{2}} vJ\right\rangle .$$

pg. 303 Change Eq. (35) to read:

$$|\psi(F_1)\rangle = b_J \left|{}^2\Pi_{\frac{3}{2}} vJ\right\rangle + a_J \left|{}^2\Pi_{\frac{1}{2}} vJ\right\rangle .$$

pg. 304 In the second sentence change F_1 and F_2 to F_2 and F_1.

pg. 306 In line 13 change former to latter.

pg. 306 Change Eq. (38) to read:

$$\sigma_v(yz)\, |n\,\Lambda\rangle = (-1)^s\, |n\, {-\Lambda}\rangle\, .$$

pg. 306 Change Eq. (39) to read:

$$\sigma_v(yz)\, |S\,\Sigma\rangle = (-1)^s\, |S\, {-\Sigma}\rangle\, .$$

pg. 306 In the first line above Eq. (40) change xz to yz and change $\chi \to -\chi$ to $\chi \to \pi - \chi$.

pg. 306 Change Eq. (40) to read:

$$Y_{L\Lambda}(\theta,\chi) \to Y_{L\Lambda}(\theta,\pi-\chi) = (-1)^\Lambda Y^*_{L\Lambda}(\theta,\chi) = Y_{L-\Lambda}(\theta,\chi).$$

pg. 307 In line 3 change $\sigma_v(xz), y \to -y$ to $\sigma_v(yz), x \to -x$.

pg. 307 In line 5 change y to x and change $C_2(y)$ to $C_2(x)$.

pg. 307 In line 6 change $C_2(y)$ to $C_2(x)$.

pg. 307 Change Eqs. (41) and (42) by replacing $(0,\pi,0)$ by $(\pi,\pi,0)$; the right side of Eq. (41) is $e^{i\pi/2}\left|\frac{1}{2},-\frac{1}{2}\right\rangle$; and the right side of Eq. (42) is $e^{i\pi/2}\left|\frac{1}{2},\frac{1}{2}\right\rangle$.

pg. 307 Change Eq. (43) to read:

$$\sigma_v(yz)\left|\frac{1}{2},\sigma\right\rangle = (-1)^{1/2}\left|\frac{1}{2},-\sigma\right\rangle .$$

pg. 307 In line 9 of the second paragraph the sentence should read: On reflection we interchange α and β in the uncoupled state so that $\Sigma \to -\Sigma$, and we pick up a phase factor $(-1)^x$, where x equals the number of electrons divided by two, i.e., $x = n/2$. Then omit the sentence beginning with “Since…”

pg. 307 In Eq. (45) change $\sigma_v(xz)$ to $\sigma_v(yz)$, and change $(-1)^{S-\Sigma}$ to $(-1)^S$.

pg. 308 In the third line below Eq. (46) change $x \to x$, $y \to -y$, and $z \to z$ to read: $x \to -x$, $y \to y$, and $z \to z$.

pg. 308 In the fourth line below Eq. (46) change $\pi - \chi$ to $-\chi$ and change $C_2(y)$ to $C_2(x)$.

pg. 308 In the fifth line below Eq. (46) change Eq. (6.59) to Eq. (6.60).

pg. 308 In Eq. (47) change $J - \Omega$ to $-J$.

pg. 308 In Eq. (48) in the second line change $\Lambda + s$ to s, $S - \Sigma$ to S, and $J - \Omega$ to $-J$.

pg. 312 Replace $a_{n\Omega}$ by $a_{n\Sigma\Omega}$ in Eq. (65) and twice in the second line from the bottom.

pg. 312 In the third line from the bottom of the page, change $\delta_{0\Lambda}$ to $\delta_{0,\Lambda}$.

pg. 313 Change Eq. (66) to read:

$$\begin{aligned} S(J';J) &= (2J'+1)(2J+1) \\ &\times \left| \sum_{\Omega'} \sum_{\Omega} a_{n'\Sigma'\Omega'}(p'^{\pm}) a_{n\Sigma\Omega}(p^{\pm}) \delta_{\Sigma,\Sigma'} (-1)^{J'-1+\Omega} \begin{pmatrix} J & 1 & J' \\ \Omega & \Omega' - \Omega & -\Omega' \end{pmatrix} \right|^2 . \end{aligned}$$

pg. 316 In reference 27, change $C_2(x)\sigma_v(yz)$ to $C_2(y)\sigma_v(xz)$.

pg. 316 Update the last line of reference 29 to read: M. H. Alexander et al. *J. Chem. Phys.* **89**, 1749 (1988).

pg. 317 Reference 31 should be rewritten to read:

As Alexander and Dagdigian [29] show, the electron distribution in the F_1 *e* Λ-doublet level is oriented preferentially in the plane of rotation and in the F_1 *f* Λ-doublet level oriented preferentially perpendicular to the plane of rotation along **J** for a single filled π orbital. The opposite applies to F_2 Λ-doublet levels. For a π^3 configuration, the preferences are reversed. The treatment outlined in F is an approximation in which the integration over only χ is considered. A more complete treatment in which the integration over θ and ϕ are included modifies Eq. (50).

pg. 320 In Eq. 16 replace $\psi_{LKM}(\mathbf{\Omega}_0)$ by $\psi_{LKM}(\mathbf{\Omega})$ and replace $\psi_{LKM}(\mathbf{\Omega})$ by $\psi_{LKM}(\mathbf{\Omega}_0)$.

pg. 325 Eq. (A-3) should have the signs in front of ν in the parentheses in the denominator $-, -, -, +, +$ so that it agrees with Eq. (2.25).