Correction to Physics of Optoelectronics (1st printing)

1. Equation 4.5.8 on page 219: remove the "prime" symbol from $|x'\rangle$ to obtain $|x\rangle$

2. Page 219, 5 lines from the bottom: The equation $R_{ab}^{+} = R_{ab}^{*} = R_{ba}^{*}$ should read as

$$R_{ab}^{+} = R_{ab}^{T*} = R_{ba}^{*}$$

3. The equation in Theorem 4.6.4 on page 223 has been replaced by the following:

$$e^{x(\hat{A}+\hat{B})} = e^{x\hat{A}} e^{x\hat{B}} e^{-x^2[\hat{A},\hat{B}]/2}$$

4. Example 4.8.1 on page 231: the equation should not have the space in $\langle b|\ \delta$

5. Pages 244 and 245 are missing a minus sign as follows.

4.11.2: Translation of the Position Operator

$$\hat{T}^{+}(\eta)\,\hat{x}\,\hat{T}(\eta) = \hat{x} + \eta$$

$$e^{i\eta\hat{p}}\hat{x}e^{-i\eta\hat{p}} = \hat{x} + \frac{\eta}{1!}[i\hat{p},\hat{x}] + \frac{\eta^2}{2!}\Big[i\hat{p},[i\hat{p},\hat{x}]\Big] + \ldots = \hat{x} + \eta$$

4.11.3 Translation of the Position-Coordinate Ket

$$\hat{T}^{+}(\eta)\,\hat{x}\,\hat{T}(\eta) = \hat{x} + \eta$$

… operator is $\hat{x}_T = \hat{x} + \eta$ and therefore …

$$x|\phi\rangle = \hat{x}_T|\phi\rangle = (\hat{x} + \eta)|\phi\rangle = (\phi + \eta)|\phi\rangle$$

… see $\phi = x - \eta$ which …

$$|\phi\rangle = \hat{T}^{+}(\eta)|x\rangle = |x - \eta\rangle$$

4.11.4 Example Using the Dirac Delta Function

$$|\phi\rangle = \hat{T}^{+}(\eta)|x'\rangle = |x' - \eta\rangle$$

$$\langle x|\hat{T}^{+}(\eta)|x'\rangle = e^{+i\eta\hat{p}_x}\langle x|x'\rangle = e^{+i\eta\hat{p}_x}\delta(x - x') = \delta(x + \eta - x') = \langle x|x' - \eta\rangle$$

Evidently

$$\hat{T}^{+}(\eta)|x'\rangle = |x' + \eta\rangle$$

6. Page 263 in Example 5.2.2, 2nd line: $y_1(t) = 0,\ y_2(t) = h$ should read

$$y_1(0) = 0,\ y_2(0) = h$$

7. Page 263, last equation should read

$$\ddot{y}_1 = \frac{(m_2 - m_1)g}{(m_1 + m_2)}$$

8. Page 335, bottom two text lines should read:

… function (5.11.13) … expression (5.11.13) …

9. Page 343, Figure P5.15: Remove the two sets of energy levels at the bottom of the figure but leave the pulley system intact.

10. The equations on pages 347–350 are not relevant to Review Exercise 5.42. The section concludes with Exercise 5.42, parts 1, 2, and 3, followed by Section 5.13, Further Reading.

11. Page 356, Section 6.2, 2nd line: The text should read "A classical Hamiltonian for electromagnetic energy stored in free space can be …"

12. Page 357, top line: The text should read "… transformation. The next section demonstrates the plane wave …"

13. Page 363, 1st line below Equation 6.2.14 should read "…potential, the previous section shows …"

14. Page 364, Section 6.2.5, top line should read: "… condition (in natural units with the speed of light c=1)."

15. Page 371, the 5th text line from the top should read "… in the mode ϕ_k while … from the mode ϕ_k."

16. Page 371, the two equations below Equation 6.3.15 should read

$$\frac{1}{\phi_k}\frac{\partial^2 \phi_k(x)}{\partial x^2} = -\lambda_k = \frac{1}{c^2}\frac{1}{T_k}\frac{\partial^2 T_k(t)}{\partial t^2}$$

$$\frac{\partial^2 T_k(t)}{\partial t^2} = -\lambda_k c^2 T_k$$

17. Page 378, the 3rd text line from the top should read "… in terms of the quadrature operators …". The words "position and momentum" have been removed.

18. Page 379, the second equation should have brackets

$$\vec{E}(\vec{r},t) = -\sum_{\vec{k}} \tilde{e}_k \sqrt{\frac{\hbar\omega_k}{\varepsilon_o V}} \left[\hat{Q}_{\vec{k}} \sin\left(\vec{k}\cdot\vec{r} - \omega_k t\right) + \hat{P}_{\vec{k}} \cos\left(\vec{k}\cdot\vec{r} - \omega_k t\right) \right]$$

19. Page 415, Figure 6.9.5, the radial vector should be labeled with $\sqrt{2}\,\alpha$.

20. Page 417, Figure 6.9.6, the length of the radial vector should be labeled as $\sqrt{2}|\alpha|$.

21. Page 436, Equation 6.12.2 should be split into two equations as follows

$$\langle\alpha|\beta\rangle = \exp\left[-\frac{|\alpha|^2+|\beta|^2}{2}\right]\exp\left(\alpha^*\beta\right) \qquad |\langle\alpha|\beta\rangle|^2 = \exp\left[-|\alpha-\beta|^2\right] \qquad (6.12.2)$$

22. Page 436, the 6th line in Example 6.12.1 should read

"Therefore, $|\langle\alpha|\beta\rangle|^2 \le \exp\left[-(5-4)^2\right] = e^{-1} = 0.37$"

23. Page 437, the top equation needs an exponent to be fixed at the end:

$$\frac{1}{\pi}\int_{\substack{\alpha-\\ \text{plane}}} d^2\alpha\ |\alpha\rangle\langle\alpha| = \frac{1}{\pi}\sum_{n,m}\frac{|n\rangle\langle m|}{\sqrt{n!m!}}\int d^2\alpha\, e^{-r^2/2}\left(\alpha^*\right)^n e^{-r^2/2}\alpha^m = \frac{1}{\pi}\sum_{n,m}\frac{|n\rangle\langle m|}{\sqrt{n!m!}}\int d^2\alpha\, e^{-r^2}\alpha^{*n}\alpha^m$$

24. Page 438, the second equation under Section 6.12.6 should read

$$|\alpha\rangle = \frac{1}{\pi}\int d^2\beta\ |\beta\rangle\exp\left[-|\beta-\alpha|^2/2\right]\exp\left(-\alpha\beta^*/2\right)$$

25. Page 441, the 1st equation under Section 6.13.2 needs an exponent to be fixed near the end of the equation

$$\sigma_P^2 = \langle n|\hat{P}^2|n\rangle - \langle n|\hat{P}|n\rangle^2 = \langle n|\hat{P}^2|n\rangle = \langle n|\frac{-i}{\sqrt{2}}\left[\hat{b}-\hat{b}^+\right]^2|n\rangle = -\frac{1}{2}\langle n|\left(\hat{b}^2+\hat{b}^{+2}-\hat{b}^+\hat{b}-\hat{b}\hat{b}^+\right)|n\rangle$$

26. Page 446, Section 6.15.1, the second text line should read "… squeezing parameter $\eta = re^{+i\theta}$." Leave off the remainder of the sentence "with(out) the minus sign."

27. Page 448, separate the two equations in 6.15.5

$$\hat{S}^+\hat{b}\,\hat{S} = \hat{b}\,\mathrm{Cosh}(r) - \hat{b}^+e^{i\theta}\mathrm{Sinh}(r) \qquad \hat{S}^+\hat{b}^+\hat{S} = \hat{b}^+\mathrm{Cosh}(r) - \hat{b}e^{-i\theta}\mathrm{Sinh}(r)$$

28. Page 448, the 3rd text line should read "where $\eta = re^{+i\theta}$ and …"

29. Page 448, 4th equation should read (complex conjugate eliminated)

$$\hat{S}^+\hat{b}\,\hat{S} = \hat{b} - \eta\,\hat{b}^+ + \frac{1}{2!}|\eta|^2\,\hat{b} - \frac{1}{3!}|\eta|^2\,\eta\,\hat{b}^+ + \ldots = \hat{b}\left(1+\frac{1}{2!}r^2+\frac{1}{4!}r^4+\ldots\right) - \hat{b}^+e^{i\theta}\left(r+\frac{1}{3!}r^3+\ldots\right)$$

30. Page 448, the line under Equation 6.15.7 should read "… squeezing parameter $\eta = re^{+i\theta}$."

31. Page 450, the 5th text line from the top should have $\eta = re^{+i\theta}$

32. Page 451, the 2nd text line from the top should also have $\eta = re^{+i\theta}$

33. Page 451, the 5th text line below Equation 6.15.13 should also have $\eta = re^{+i\theta}$.

34. Page 455, Equation 6.16.8 consists of two equations and should have several spaces between them.

$$\hat{S}^{+}\hat{b}\hat{S} = \hat{b}\,\mathrm{Cosh}(r) - \hat{b}^{+}e^{i\theta}\mathrm{Sinh}(r) \qquad \hat{S}^{+}\hat{b}^{+}\hat{S} = \hat{b}^{+}\mathrm{Cosh}(r) - \hat{b}e^{-i\theta}\mathrm{Sinh}(r)$$

35. Page 456, 3rd text line from top should read "The terms $\langle 0|\hat{b}^{2}|0\rangle$, $\langle 0|\left(\hat{b}^{+}\right)^{2}|0\rangle$ give zero …"

36. Page 458, 3rd equation from the top should have "Tanh(r)" rather than "tan h(r)".

Errata Set 3

1. Page 216, Ex 4.5.1: $|bh\rangle$ should read $|b\rangle$

2. Page 223, Thm 4.6.3: remove the word "for" and insert "then".

3. Section 4.13: remove the "^" from the unit vectors and use the "~" instead.

4. Page 427, Eq. 6.11.5: insert several space before the symbol $|\alpha\rangle$

5. Page 431, Eq. 6.11.3 should be labeled 6.11.13

6. Page 454, Eq 6.18.8a should be labeled 6.16.4a

7. Page 455, Eq 6.16.9 should be labeled 6.16.5

8. Page 456, Eq 6.16.13 should be labeled 6.16.9

9. Page 457, Eq 6.16.16 should be labeled 6.16.12

10. Page 457, Eq 6.16.7 should be labeled 6.16.13

11. Page 457, Eq 6.16.18 should be labeled 6.16.14

12. Page 458, Eq 6.16.19 should be labeled 6.16.15

13. Page 247, 2nd text line from the top: The correct form for the angular momentum L_z and the commutator should be:

$L_z = -i\hbar\,\partial/\partial\theta$ and $[\theta, \hat{L}_z] = i\hbar$

14. Page 270, Equation 5.4.7: Replace $\bar{L}_i$ with L_i^{-}.

15. Page 270, Equation 5.4.11 replace with the following equations and text.

$$\Delta V_j \pi_j = p_j = \frac{\partial L}{\partial \dot{q}_j} = \Delta V_j \frac{\partial \bar{L}_j}{\partial \dot{q}_j} \quad (5.4.11a)$$

so that

$$\pi_j = \frac{\partial \bar{L}_j}{\partial \dot{q}_j} \underset{\Delta V_i \to 0}{\longrightarrow} \pi(\vec{r}, t) = \frac{\partial L(\eta, \ldots)}{\partial \dot{\eta}} \quad (5.4.11b)$$

from equation 5.4.10.

16. Page 273, Example 5.4.1: Make the replacements (note the extra minus sign):

$$L = \frac{\rho}{2}\dot{\eta}^2 - \frac{\beta}{2}(\partial_z \eta)^2 \quad \text{and} \quad \frac{\partial}{\partial z}\frac{\partial L}{\partial(\partial_z \eta)} = -\beta \frac{\partial^2 \eta}{\partial z^2}$$

17. Page 302, Equation 5.8.18: insert space between the two equations to read:

$$\left[\hat{N}, \hat{a}\right] = \left[\hat{a}^+ \hat{a}, \hat{a}\right] = \left[\hat{a}^+, \hat{a}\right]\hat{a} = -\hat{a} \qquad \left[\hat{N}, \hat{a}^+\right] = \left[\hat{a}^+ \hat{a}, \hat{a}^+\right] = \hat{a}^+\left[\hat{a}, \hat{a}^+\right] = \hat{a}^+ \quad (5.8.18)$$

18. Page 303, last equation (#3): Need spaces between the two equations:

$$\left[\hat{N}, \hat{a}\right] = -\hat{a} \qquad \left[\hat{N}, \hat{a}^+\right] = \hat{a}^+$$

19. Page 405, Equation 6.8.1b should have square roots as follows:

$$\hat{E}\left|n\right\rangle = i\sqrt{\frac{\hbar\omega}{2\varepsilon_o V}}\left[\sqrt{n}\left|n-1\right\rangle e^{ikz-i\omega t} - \sqrt{n+1}\left|n+1\right\rangle e^{-ikz+i\omega t}\right] \quad (6.8.1b)$$

20. Page 405, Equation 6.8.2 should have square roots as follows:

$$\bar{E} = \left\langle n\middle|\hat{E}\middle|n\right\rangle = i\sqrt{\frac{\hbar\omega}{2\varepsilon_o V}}\left[\sqrt{n}\left\langle n\middle|n-1\right\rangle e^{ikz-i\omega t} - \sqrt{n+1}\left\langle n\middle|n+1\right\rangle e^{-ikz+i\omega t}\right] = 0 \quad (6.8.2)$$