Corrections for Gerry-Knight Book

Chapter 2

Eq. 2.1 should read:

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

Eq. 2.27 should read:

$$\hbar\omega\left(\hat{a}^{\dagger}\hat{a}^{\dagger}\hat{a}+\frac{1}{2}\hat{a}^{\dagger}\right)\left|n\right\rangle=E_{n}\hat{a}^{\dagger}\left|n\right\rangle$$

Eq. 2.28 should read

$$\hbar\omega \left[\left(\hat{a}^{\dagger} \hat{a} a^{\dagger} - \hat{a}^{\dagger} \right) + \frac{1}{2} \hat{a}^{\dagger} \right] |n\rangle = E_n \hat{a}^{\dagger} |n\rangle,$$

Eq. 2.43 should read

$$\langle n+1 | \hat{a}^{\dagger} | n \rangle = \sqrt{n+1} \langle n+1 | n+1 \rangle = \sqrt{n+1}$$

(dagger was missing)

Eq. 2.117 should look like this:

$$\left|\left\{n_{j}\right\}\right\rangle = \prod_{j} \frac{\left(\hat{a}_{j}^{\dagger}\right)^{n_{j}}}{\sqrt{n_{j}!}} \left|\left\{0\right\}\right\rangle$$

The factorial is under the square root but it has not been printed that way.

The line below Eq. 2.146 should read:

It can be shown, in a manner similar to the derivation of \overline{n} , that (moved the second comma to after the \overline{n})

Eq. 2.147 should read:

$$\overline{n} \approx \begin{cases} \frac{k_B T}{\hbar \omega} & (k_B T >> \hbar \omega) \\ \exp(-\hbar \omega / k_B T) & (k_B T << \hbar \omega) \end{cases}$$
 (the second line was wrong)

Eq. 2.164 should read:

 $|\psi_{n00}(r=0)|^2 = \frac{1}{\pi n^3 a_0^3}$ (the square should be outside the modulus)

Eq. 2.166 should be

$$\Delta r_{v} = -\frac{e}{m} \frac{E_{v}}{4\pi^{2}v^{2}} \exp(2\pi v it)$$

Eq. 2.168 should read

$$\Delta E = \frac{2}{3} \left(\frac{e^2}{\hbar c}\right)^2 \left(\frac{\hbar}{mc}\right)^2 \frac{hc}{\pi^2 n^3 a_0^3} \int \frac{dv}{v} \quad \text{(exponent 2 was missing)}$$

Eq. 2.178 should read

$$U(d) = \frac{\pi^2 \hbar c}{4d^3} L^2 \left[\frac{1}{2} F(0) + \sum_{n=1}^{\infty} F(n) - \int_{0}^{\infty} dz F(z) \right]$$

(the last term, under the integral sign, should have had F(z) instead of F(n))

Eq. 2.182 should be

 $F(d) = -U'(d) = -\frac{\pi^2 \hbar c}{240 d^4}$ (minus sign missing from middle term)

Chapter 3

Eq. 3.7 should read

$$C_n = \frac{\alpha}{\sqrt{n}} C_{n-1} = \frac{\alpha^2}{\sqrt{n(n-1)}} C_{n-2} = \dots$$
$$= \frac{\alpha^n}{\sqrt{n!}} C_0$$

(in the second expression of first line should be α instead of 2)

Eq. 3.27 should read

$$\mathcal{P}(\varphi) = \frac{1}{2\pi} |\langle \varphi | \alpha \rangle|^2$$
$$= \frac{1}{2\pi} e^{-|\alpha|^2} \left| \sum_{n=0}^{\infty} e^{in(\varphi - \theta)} \frac{|\alpha|^n}{\sqrt{n!}} \right|^2$$

(the factorial should be inside the square root).

Eq. 3.43 should read

$$\hat{D}(\alpha)\hat{D}(\beta)|0\rangle = \hat{D}(\alpha)|\beta\rangle$$
$$= \exp\left[i\operatorname{Im}(\alpha\beta^{*})\right]|\alpha + \beta\rangle$$

 $(|0\rangle$ was missing on left hand side)

Eq. 3.71 should read

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

(square was missing in the second line)

Eq. 3.72 should read

$$\langle \alpha | \psi \rangle = \exp\left(-\frac{1}{2}|\alpha|^2\right) \sum_{n=0}^{\infty} \psi_n \frac{\left(\alpha^*\right)^n}{\sqrt{n!}}$$

= $\exp\left(-\frac{1}{2}|\alpha|^2\right) \psi\left(\alpha^*\right)$

(the factorial in the first line should be under the square root)

Eg. 3.94b should read

$$f(\alpha) = \frac{1}{\pi^2} \int g(u) e^{u^* \alpha - u \alpha^*} d^2 u$$

(need d^2u instead of $d^2\alpha$)

Eq. 3.96 should read

$$P(\alpha) = \frac{e^{|\alpha|^2}}{\pi^2} \int e^{|u|^2} \langle -u | \hat{\rho} | u \rangle e^{u^* \alpha - u \alpha^*} d^2 u$$

(the ρ needs to be $\hat{\rho}$)

Chapter 4

In the paragraph after Eq. 4.33, the second sentence should read If the frequency of the radiation, ω , is near resonance with the atomic transition frequency ω_{fi} , the second term clearly dominates the first, assuming $\omega_{fi} > 0$. (have added the phrase "assuming $\omega_{fi} > 0$.")

In the second line on page 81, Eq. 4.36 should be cited, not 4.35.

On page 84, in the second line of the second paragraph up from the bottom, Eq. (4.57) should be cited, not (4.51).

On page 85, in the line below Eq. 4.61, should cite Eq. (4.54) instead of (4.57).

Eq. 4.46 should read

$$\hat{\mathbf{E}}(t) = i \left(\frac{\hbar\omega}{2\varepsilon_0 V}\right)^{1/2} \mathbf{e} \left[\hat{a}e^{-i\omega t} - \hat{a}^{\dagger}e^{i\omega t}\right]$$

(needed the \hat{a}^{\dagger} in second term)

On page 84, the reference to Eq. (4.51) should instead be to Eq. (4.57).

On page 100, the second line should start with $|g\rangle |n+1\rangle$ instead of $|g\rangle |n-1\rangle$.

Eq. 4.68 should read

$$\frac{A}{BU(\omega)} = \exp(\hbar\omega/kT) - 1$$

(the last ")" was in the wrong place)

The second line of Eq. 4.93 should read

$$\left[\hat{\sigma}_{3},\hat{\sigma}_{\pm}\right] = \pm 2\hat{\sigma}_{\pm}.$$

(the \pm was missing from the right hand side)

Eq. 4.144 should read

$$\boldsymbol{H}^{(n)} = \hbar \begin{bmatrix} n\omega + \frac{1}{2}\omega_0 & \lambda\sqrt{n+1} \\ \lambda\sqrt{n+1} & (n+1)\omega - \frac{1}{2}\omega_0 \end{bmatrix}$$

Eq. 4.145 should read

$$E_{\pm}(n) = \left(n + \frac{1}{2}\right) \hbar \omega \pm \frac{1}{2} \hbar \Omega_n(\Delta)$$

(the ¹/₂ was missing from the last term)

On page 101, the third line of the text should begin with

$$\hbar(\omega_0/2 + n\,\omega)$$

(the \hbar of the second term has been changed to *n*)

The last 3 problems of chapter 4 should be numbered, 10, 11, and 12.

Chapter 5

Eq. 5.15 should read

$$\langle E^*(x_1)E(x_2)\rangle = \sqrt{\langle |E(x_1)|^2\rangle}\sqrt{\langle |E(x_2)|^2\rangle}$$

Chapter 6

On page 144 after Eq. 6.29, the D_2 should be D_1 while two lines below, after Eq. 6.30, the D_1 should be D_2 .

Eq. 6.34 should read

$$\left|\frac{ie^{i\theta}\alpha}{\sqrt{2}}\right\rangle \left|\frac{\alpha}{\sqrt{2}}\right\rangle \xrightarrow{BS_{2}} \left|\frac{i(e^{i\theta}+1)\alpha}{2}\right\rangle \left|\frac{(1-e^{i\theta})\alpha}{2}\right\rangle$$

(note changes on the right hand side)

Chapter 7

Eq. 7.97 should read

$$\left\langle \left(\Delta \hat{n}\right)^{2}\right\rangle = \left\langle \hat{n}\right\rangle + \int d^{2}\alpha P(\alpha) \left[\left|\alpha\right|^{2} - \left\langle \hat{a}^{\dagger}\hat{a}\right\rangle \right]^{2}$$

(the $\left<\hat{a}^{\dagger}\hat{a}\right>$ inside the bracket should not be squared)

Chapter 9

Eq. 9.20 should read

$$\begin{split} \left|\psi_{\text{out}}\left(\theta\right)\right\rangle &= \frac{i}{\sqrt{2}}\cos\theta\left(\left|2H\right\rangle_{1}\left|0\right\rangle_{2} + \left|0\right\rangle_{1}\left|2H\right\rangle_{2}\right) \\ &+ \frac{1}{2}\sin\theta\left(\left|H\right\rangle_{1}\left|V\right\rangle_{2} - \left|V\right\rangle_{1}\left|H\right\rangle_{2}\right) \\ &+ \frac{i}{2}\sin\left(\left|H,V\right\rangle_{1}\left|0\right\rangle_{2} - \left|0\right\rangle_{1}\left|H,V\right\rangle_{2}\right) \end{split}$$

The line just after this equation: "where the terms containing the single photon states no longer cancel each other as the photons have different polarizations." should be replaced by the following: "where $|H,V\rangle$ represents the state where two photons of orthogonal polarization, hence distinguishable, emerge along the same direction."

Eq. 9.21 should read

$$|\psi_{\text{out}}(\pi/2)\rangle = |\Psi^{-}\rangle = \frac{1}{2} (|H\rangle_{1}|V\rangle_{2} - |V\rangle_{1}|H\rangle_{2}) + \frac{i}{2} (|H,V\rangle_{1}|0\rangle_{2} - |0\rangle_{1}|H,V\rangle_{2}).$$

On page 220, the footnote at the bottom of the page should be removed.

The second line of Eq. 9.23 should read

$$=\frac{1}{2}|\theta_{1}\rangle(|V\rangle_{2}\cos\theta_{1}-|H\rangle_{2}\sin\theta_{1})$$

(missing 1/2 factor)

The second line of Eq. 9.24 should read

$$=\frac{1}{4}\sin^2\left(\theta_2-\theta_1\right).$$

(1/4 instead of 1/2)

Chapter 10

Eq. 10.59 should read

$$\left|\Psi(t),\pi/2\right\rangle = \frac{1}{2} \left[\left|e\right\rangle \left(e^{-i\chi t(n+1)} - e^{+i\chi tn}\right) + \left|g\right\rangle \left(e^{-i\chi t(n+1)} + e^{+i\chi tn}\right)\right]\right|n\rangle$$

(note the position of the $|n\rangle$)

Appendix A

Eq. A32 should read

$$\begin{split} \hat{\rho} &= \left|\Psi\right\rangle \left\langle\Psi\right| = \sum_{i,j,k,l} c_{ij} c_{kl}^* \left|a_i\right\rangle \left\langle a_k \left|\otimes\right|b_j\right\rangle \left\langle b_l\right| \\ &= \sum_{i,j,k,l} \rho_{ij,kl} \left|a_i\right\rangle \left\langle a_k \left|\otimes\right|b_j\right\rangle \left\langle b_l\right|, \end{split}$$

(indices in bra vector corrected)

The second line of Eq 4.106 should read:

$$\hat{H}_{II} = -\hbar\Delta |g\rangle \langle g| + \hbar\lambda \left(\hat{\sigma}_{+}\hat{a} + \hat{\sigma}_{-}\hat{a}^{\dagger}\right)$$