Errata in *Physical Mathematics*

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First-Edition List

The first-edition list is at `http://quantum.phys.unm.edu/errata.html`.

Second-Edition List

Chapter 1

Section 1.5, page 10, equation 1.63: The index ℓ should be k.

In Section 1.11, on page 25

In Section 1.13, on page 25, equation 1.70 should be

$$\mathrm{Tr}(a') = \mathrm{Tr}(u^{-1}\, a\, u) = \mathrm{Tr}(a\, u\, u^{-1}) = \mathrm{Tr}(a).$$

(Thanks to Spencer Dimitroff.)

A better statement of exercise 1.40 on page 83 of Chapter 1 is:
The coherent state $|\{\alpha(\boldsymbol{k},\ell)\}\rangle$ is an eigenstate of the annihilation operator $a(\boldsymbol{k},\ell)$ with eigenvalue $\alpha(\boldsymbol{k},\ell)$ for each wavenumber $\boldsymbol{k}$ and polarization ℓ

$$a(\boldsymbol{k},\ell)|\{\alpha(\boldsymbol{k},\ell)\}\rangle = \alpha(\boldsymbol{k},\ell)|\{\alpha(\boldsymbol{k},\ell)\}\rangle. \tag{1}$$

The positive-frequency part $E_i^{(+)}(t,\boldsymbol{x})$ of the electric field is a sum over $\boldsymbol{k}$ and ℓ

$$E_i^{(+)}(t,\boldsymbol{x}) = \sum_{\boldsymbol{k}} \sum_{\ell=1}^{2} a(\boldsymbol{k},\ell)\, e_i(\boldsymbol{k},\ell)\, e^{i(\boldsymbol{k}\cdot\boldsymbol{x}-\omega t)} \tag{2}$$

in which $\boldsymbol{e}(\boldsymbol{k},\ell) = \boldsymbol{k} \times \boldsymbol{\epsilon}(\boldsymbol{k},\ell)$ and $\boldsymbol{\epsilon}(\boldsymbol{k},\ell)$ is proportional to a polarization vector. Show that $|\{\alpha_k\}\rangle$ is an eigenstate of $E_i^{(+)}(t,\boldsymbol{x})$ as in (1.490) and find its eigenvalue $\mathcal{E}_i^{(+)}(t,\boldsymbol{x})$.

Chapter 2

On page 85, between equations (2.10) and (2.11)

$$\hat{\boldsymbol{e}}_j = \boldsymbol{e}_/ h_j \quad \text{should be} \quad \hat{\boldsymbol{e}}_j = \boldsymbol{e}_j / h_j.$$

On page 89, equation 2.36 should be (Thanks to Spencer Dimitroff)

$$\boldsymbol{E} = \hat{\boldsymbol{r}} \frac{\rho R}{3\epsilon_0} = \hat{\boldsymbol{r}} \frac{b}{R^2},$$

and equation 2.38 should be

$$\boldsymbol{dS} = h_i \hat{\boldsymbol{e}}_i du_i \times h_j \hat{\boldsymbol{e}}_j du_j = \sum_{k=1}^{3} \epsilon_{ijk}\, \hat{\boldsymbol{e}}_k\, h_i h_j\, du_i du_j.$$

Chapter 3

In the top line on page 114, $c_2 = 0$ should be $f_2 = 0$.

In the line immediately after equation (3.113), $c_{2n} = 0$ should be $f_{2n} = 0$.

Chapter 4

On page 135 of Section 4.3, equation 4.49 of Example 4.4 should be

$$\delta\big(g(x)\big) = -\frac{\delta'(x - x_0)}{|g''(x_0)|},$$

and as noted there, this relation holds only if x_0 is the only root of $g(x)$ and $g(x_0) = g'(x_0) = 0$, and if $f \in C^1$ and $f(x_0) = 0$.

Section 4.10, example 4.13, page 147: In equations 4.135–4.139, the prefactor τ should be τ^{-1}. The last line of equation 4.138 is then

$$L(t) = \frac{\sin(\omega t) - \omega\tau \cos(\omega t)}{1 + (\omega\tau)^2}.$$

Chapter 5

On page 171 in equation 5.95 of example 5.12 of Section 5.9, each of the two occurrences of $\hbar E$ should be $2\hbar E$.

Chapter 6

On page 199 of Section 6.7, equation 6.72 should read

$$\sum_{n=0}^{\infty} \frac{|z-z_0|^n}{n!} |f^{(n)}(z_0)| \leq M \sum_{n=0}^{\infty} \frac{|z-z_0|^n}{R^n}.$$

Chapter 7

In the fourth line on page 254 in example 7.7 of Section 7.3, the inline equation for $f(\rho, \phi, z)$ should be

$$f(\rho, \phi, z) = J_n(\alpha\rho)e^{in\phi}e^{\alpha z}.$$

Also on page 254, the first sentence after equation 7.35 should be: The first and last terms are functions of r, and the two middle terms are functions of θ.

On page 255, equation 7.39 should be

$$\partial_a f = \frac{\partial f}{\partial x^a} \quad \text{and} \quad \partial^a f = \frac{\partial f}{\partial x_a}, \quad \text{so} \quad \partial^0 f = -\partial_0 f. \tag{3}$$

On page 272 of Section 7.13, equation 7.167 should be

$$\frac{dS}{dt} = L = \frac{\partial S}{\partial t} + \sum_i \frac{\partial S}{\partial q_i} \dot{q}_i = \frac{\partial S}{\partial t} + \sum_i p_i \dot{q}_i.$$

On page 281 of Section 7.20, equation 7.217 should be

$$0 = \sum_{k=0}^{n} c_k \, t^{n-k} \, \frac{d^k y}{dt^k}.$$

On page 286, just below equation 7.241 of Section 7.24, $h_0 = 1$ should be $h_2 = -1$.

On page 297 in equation 7.310 of Section 7.33, $1 - x^2$ should be $1 - x'^2$.

On page 318 in equation 7.446 of Section 7.41, $\delta_{n\ell}$ should be δ_{nk}.

Chapter 9

On page 355 in the second line of Section 9.10, $\alpha = 0$ should be $k = 0$.

On page 360 in the last sentence of the first paragraph of Section 9.14, the words "is usually (and inexplicably) called **recombination**" should be "is called **decoupling**."

On page 362 equation 9.128 of Section 9.14 should be

$$\frac{3.8 \times 10^5 \times 1100 \times 180^\circ}{\sqrt{3} \times 13.8 \times 10^9 \times \pi} = 1.0^\circ,$$

and in the following three sentences "one degree" and "1°" should be "0.6°."

Chapter 10

On page 370 in example 10.1: on the line after equation 10.27, $\sin(n(\theta - \theta_0))$ should be $\sin(n\theta - \theta_n)$; in equation 10.29, x should be r; and in equation 10.30, $\sin[n(\theta - \theta_0)]$ should be $\sin(n\theta - \theta_n)$.

On page 375, in example 10.3, in the first line of the first paragraph after equation 10.61, B_z should be B^z; and in the first line of the first paragraph after equation 10.63, E_z should be E^z.

Chapter 11

On page 406, Section 11.16, in equation 11.68, ${f^c}_{ab}$ should be $i\,{f^c}_{ab}$, so that equation should read

$$[t_a, t_b] = \sum_{c=1}^{n} i\,{f^c}_{ab}\,t_c \quad \text{and} \quad [t'_a, t'_b] = \sum_{c=1}^{n} i\,{f^c}_{ab}\,t'_c.$$

Similarly, on page 407, equation 11.70 should be

$$[t_a, t_b] = i\, f^c_{ab}\, t_c \quad \text{and} \quad [t'_a, t'_b] = i\, f^c_{ab}\, t'_c.$$

On page 416, in Section 11.21, in the last line of Example 11.21

$$\frac{2\ell+1}{4\pi} \quad \text{should be} \quad \frac{4\pi}{2\ell+1}$$

as in the statement (9.123) of the addition theorem.

Chapter 12

In the sentences before and after equation 12.1 on the first page (451) of Chapter 12, the words "difference" and "distance" should be "separation." Similarly on page 453 just before equation 12.13, "distance" should be "separation."

On page 452, in the line of text just before example 12.1, "explcity" should be "explicitly."

Chapter 13

On page 520 in the last sentence of the first paragraph of Section 13.47, the words "**recombination**, a term that makes sense only if the universe is cyclic" should be "**decoupling**."

On page 521 of Section 13.47, the term $+a(t_m)$ should be added to the right-hand side of the second of equations 13.306 so that it reads

$$a(t) = \left(\frac{3H_0\sqrt{\Omega_m}\,(t-t_m)}{2}\right)^{2/3} + a(t_m). \tag{4}$$

Also, the clause after it should read, "in which t is a time well inside the era of matter and $t_m \sim$ 50,000 years."

On page 526, in Section 13.51, equation 13.319 should be

$$D_\ell\, c^a_{\ k} = c^a_{\ k,\ell} - \Gamma^j_{\ k\,\ell}\, c^a_{\ j} + \omega^a_{\ b\,\ell}\, c^b_{\ k}. \tag{5}$$

And in the sentence that contains equation 13.322, "So too the **spin connection** $\omega^a_{\ b\,\ell}$ is defined so as" should be "Similarly Cartan defined the **spin connection** $\omega^a_{\ b\,\ell}$ so as".