ERRATA TO "QUANTUM FIELD THEORY"

(second and later printings)

G. B. Folland

Last updated March 27, 2023

Additional corrections will be gratefully received at `folland@math.washington.edu` .

"line $-n$" means "line n from the bottom."

Notes: (1) The world of quantum field theory texts has recently welcomed a very significant addition: *Quantum Field Theory: Lectures of Sidney Coleman* (B. G. Chen et al., eds.), World Scientific, 2019. Coleman was a brilliant physicist and a legendary lecturer, and this book is based on the videotapes of the course he gave in 1975–6 together with notes taken by various people of later incarnations of that course, which have served as informal texts for many physics students over many years. The book is great, and its point of view is pretty compatible with mine. The advantage of my book is brevity (300 pages instead of 1100), but if you find places where my explanations are too terse or too incomplete, you should consult Coleman.

(2) Update on the anomalous magnetic moment of the muon, April 2021: The figure quoted on line 4 of page 251 is more than 30 years old. The most recent experimental results give the value $(116592061 \pm 41) \times 10^{-11}$. The generally accepted theoretical value (according to the Standard Model) is $(116591810 \pm 43) \times 10^{-11}$. The discrepancy is large enough to be significant; whether it leads to physics outside the Standard Model or to new corrections of the experimental or theoretical values remains to be seen.

Page 12, line -3: $SO^{\uparrow}(3,1) \quad \to \quad SO^{\uparrow}(1,3)$

Page 15, last display: The formula for X_f should be $\displaystyle\sum \left(\frac{\partial f}{\partial x_j} \frac{\partial}{\partial p_j} - \frac{\partial f}{\partial p_j} \frac{\partial}{\partial x_j} \right)$

Page 17, line 8: The equalities after "But" should be $X_f H = \{f, H\} = df/dt$.

Page 30, 5th display: in the first term on the right, $m|\mathbf{v}|^2 \quad \to \quad m\mathbf{v}$

Page 39, line 12: $\langle u|V|w\rangle \quad \to \quad \langle Vu|Vw\rangle$

Page 45, 2nd line after (3.13): it (in exponent) $\quad \to \quad t$

Page 47, line 15: $(2\pi)^n \quad \to \quad (2\pi\hbar)^n$

Page 49, line -1: $m^{-1}\nabla \cdot \nabla \quad \to \quad m^{-1}\nabla \cdot \nabla f$

Page 56, line -7: The correction to page 15 above entails the correction $X_{l_1} \quad \to \quad -X_{l_1}$.

Page 57, line 4: Interchange $\sin t$ and $-\sin t$.

Page 58, line 15: $\frac{1}{2} i\sigma_j \quad \to \quad \frac{1}{2i}\sigma_j$

Page 58, line 18 and page 59, line 7 (2 places): $\frac{\hbar}{i} \quad \to \quad i\hbar$

Page 59, (3.33): $\mathcal{H}_l$ should be the linear span of the set on the right.

Page 60, line 4: $\frac{1}{2} \quad \to \quad \frac{1}{2}v_\pm$

Page 66, line 3 of 2nd paragraph: rest mass $\quad \to \quad$ squared rest mass

Page 69, line -5: $j^0 \quad \to \quad j^\mu$ and quantity $\quad \to \quad$ current

Page 72, 4th display: $\gamma^1\gamma^2\gamma^3 \quad \to \quad \frac{1}{i}\gamma^1\gamma^2\gamma^3$

Page 73, lines 6 and 7: $\nabla^2 \quad \to \quad \Box$

Page 74, display after (4.27): Interchange + and − in front of sums.

Page 75, line 10: $\psi_L - \psi_R \quad \to \quad \psi_R - \psi_L$

Page 77, line -3: as $\rho \cong \bigoplus_0^\infty \pi_l \quad \to \quad$ as a direct sum of π_l-isotypic components

Pages 85–6: Replace the text from the words "that are" at the bottom of p. 85 to "acts is" on lines 2–3 of p. 86 by the following: of the form $f(a, A) = e^{i\langle p,a\rangle} f_0(p)$ where $p = Ap_m^+ \in X_m^+$ and f_0 is square-integrable with respect to the invariant measure on X_m^+. Since f_0 carries all the information, the Hilbert space on which $\pi_{m,0}$ acts can be identified with

Page 86, line 8: $\mathbf{p}\cdot\mathbf{x} \quad \to \quad i\mathbf{p}\cdot\mathbf{x}$

Page 88, 5th display, first line: $S(A^{-1}) \quad \to \quad \Phi(A^{-1})$

Page 88, (4.44): $\mathbf{p}\cdot\mathbf{x} \quad \to \quad i\mathbf{p}\cdot\mathbf{x}$

Pages 91–94, several places: Scalar products written in the form $\langle\cdot,\cdot\rangle$ should be $\langle\cdot|\cdot\rangle$.

Page 94, 2nd line after (4.55): $(-1)^j \quad \to \quad (-1)^{j-1}$

Page 98, line -5: $\frac{1}{2}\sum \omega_j x_j^2 \quad \to \quad \frac{1}{2}\sum \omega_j^2 x_j^2$

Page 101, line -4: $A_j^* \quad \to \quad A_j^\dagger$

Page 102, 2nd display: $A_{\mathbf{p}}^* \quad \to \quad A_{\mathbf{p}}^\dagger$

Page 106, line 9: $v(\mathbf{p})^* \quad \to \quad u(\mathbf{p})^*$

Page 108, (5.19), and the first display on page 109: The + and − signs in the exponents should be switched.

Page 108, line -10: $\sqrt{\omega_j/2}(A_j - A_j^\dagger) \quad \to \quad (1/i)\sqrt{\omega_j/2}(A_j - A_j^\dagger)$

Page 110, 2nd display: $\omega'_{\mathbf{p}} \quad \to \quad \omega_{\mathbf{p}'}$

Page 112, line -1: of the $\quad \to \quad$ the

Page 113, formulas (5.29): The vectors called $v(\mathbf{0}, +)$ and $v(\mathbf{0}, -)$ here should be $-v(\mathbf{0}, -)$ and $v(\mathbf{0}, +)$, respectively. (See Weinberg [131], (5.5.36).)

Page 113, 2nd line above (5.30): $U \quad \to \quad U'$

Page 114, 6th line before (5.34): (4.15) $\quad \to \quad$ (4.21)

Page 115, 3rd display after (5.35) and the following line: $mI \quad \to \quad I$ (in three places)

Page 115, line -1: $\sigma \quad \to \quad s$

Page 117, 6th line after (5.41): Delete "(the same one for each ν)".

Page 120, lines -6 to -4: The statement in parentheses is incorrect; the assertion that "$\phi(x)$ creates a particle at x" has to be interpreted more loosely. See p. 152 for a more cogent justification of Axiom 6 and T. D. Newton and E. P. Wigner, Localized states for elementary

systems, *Rev. Modern Phys.* **21** (1949), 400–406, for a discussion of the problems in precisely localizing the position of a relativistic particle.

Page 129, 11th line after (6.13): (6.17) $\to$ (6.13)

Page 129, 13th line after (6.13): the the $\to$ the

Page 143, (6.34): $H_I \to \mathcal{H}_I$ (two places)

Page 143, (6.35): $\prod_1^{k_{\text{out}}} \to \prod_{k_{\text{out}}}^1$ (ordering is reversed)

Page 144, line 2: $e^{iq_\mu x^\mu} \to e^{-iq_\mu x^\mu}$, $e^{-iq_\mu x^\mu} \to e^{iq_\mu x^\mu}$

Page 144, line 4: $e^{iq_\mu x^\mu} \to e^{-iq_\mu x^\mu}$, $e^{ip_\mu x^\mu} \to e^{-ip_\mu x^\mu}$

Page 146, 3rd display: $v(\mathbf{q}, t, \pi) \to v(\mathbf{q}, t, \overline{\pi})$

Page 151, line 11: Delete the second "equation".

Page 152, 2nd display: $\leq 0 \to < 0$

Page 168, (6.65): $p_\beta - p_\alpha \to p^{\text{in}} - p^{\text{out}}$

Page 169, line −6: $p_\beta - p_\alpha \to \mathbf{p}_\beta - \mathbf{p}_\alpha$

Page 171, display after (6.70): $p^{\text{out}} \to \mathbf{p}^{\text{out}}$

Page 172, (6.71): Delete "spins,". (R contains the sum over spins.)

Page 178, line −10: (6.68) $\to$ (6.69)

Page 179, (6.84): 32 $\to$ 64

Page 188, 2nd line of display after (6.103): $u_j^*(p_j^{\text{out}}) \to u_j^*(\mathbf{p}_j^{\text{out}})$ and $u_k(p_k^{\text{in}}) \to u_k(\mathbf{p}_k^{\text{in}})$

Page 201, line 5: $z_{n+1} \to x_{n+1}$

Page 201, (7.7): $(n-1)! \to (I-1)!$ and $I+1 \to I$

Page 201, (7.8): $I+1 \to I$

Page 204, line −2: $2n-k \to 2n-2k$

Page 205, line 2: $(1+t)^{-n} \to (1+t)^n$

Page 205, 2nd line after (7.14): nonnegative $\to$ nonpositive

Page 206, 3rd line above §7.4: and and $\to$ and

Page 212, 4th line after (7.28): $\mathcal{L}_0 \to \mathcal{L}'$

Page 213, 3rd display: $J_d(0) \to 2J_d(0)$; also, "$\lim_{d\to 4}$" is missing.

Page 214, (7.29): $\Delta(p) \to \widehat{\Delta}(p)$

Page 224, line before (7.43): $q \to k$

Page 228, line −1: $k_\mu \to q_\mu$

Page 235, line 3: A factor of $1/\Gamma(d/2)$ is missing, but it becomes 1 as $d \to 4$.

Page 235, line 5: $+x(1-x) \to -x(1-x)$

Page 241, (7.74): $\alpha(1-\alpha) \to x(1-x)$

Page 249, line −3: $(u_l \quad -u_s) \to (u_l^\dagger \quad -u_s^\dagger)$

Page 251, line 4: See Note 2 on the first page of this document.

Page 263, line 6: $e^{im\xi|^2/2\tau} \quad \to \quad e^{im|x|^2/2\tau}$

Page 264, line 3: $\sum_0^{N_1} \quad \to \quad -\sum_0^{N-1}$

Page 273, (8.27), and page 274, line 3: $dx \quad \to \quad d^4x$

Page 274, 2nd line before 2nd display: $1/2i \quad \to \quad i/2$

Page 276, lines 12 and 13: $\phi \quad \to \quad h$ (two places) and $f \quad \to \quad F$

Page 300, (9.4): $\partial_\mu \widetilde{\phi}_j \quad \to \quad \partial \widetilde{\phi}_j$

Page 302, line -3: $n - m \quad \to \quad N - m$