Errata to "An Introduction to the Physics of Particle Accelerators", 2nd Ed.

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Chapter 3

1. p. 54: Line before Eq. (3.95): Change "Subtracting 1 . . . " to "Subtracting **I** . . . ".
2. p. 56, Change the two lines before Eq.(3.110) to: "The time derivative of a function of coordinates and momenta $f(\vec{x}, \vec{P}; t)$ can be calculated by Liouville's equation[1] which is easily derived using the chain rule:".
3. p. 60: Add $+\mathcal{O}(h^3)$ to Eq. (3.128). Also change the two $\mathbf{G}_j$'s on the right-hand side to $\alpha_j \mathbf{G}_j$.
4. p. 61: Eq. (3.133) should read:

$$b = -\frac{2^{1/3}}{2 - 2^{1/3}}.$$

5. p. 61, second line from bottom: First condition of bilinearity should read:

$$[ax + by, z] = a[x, z] + b[y, z].$$

6. p. 65, line after Eq. (3.143) should read: which is not quite antisymmetric. . .
7. p. 68, line after Eq. (3.167): Change "term" to "terms".
8. Problem 3–3, second line: Change the reference number "78" to "7,8".
9. Problem 3-9, line after equation should start: Note that this gives . . . .

Chapter 4

10. p. 87, Eq. (4.57) should be

$$\vec{B}(s) = B_0 \hat{s} \frac{\sqrt{l^2 + 4a^2}}{2l} \left[\frac{s}{\sqrt{s^2 + a^2}} + \frac{l - s}{\sqrt{(s - l)^2 + a^2}} \right].$$

11. p. 88, The last line of Eq. (4.59) should read:

$$= -B_0 \frac{\sqrt{l^2 + 4a^2}}{2l} \left(\frac{a^2}{(s^2 + a^2)^{3/2}} - \frac{a^2}{[(s - l)^2 + a^2]^{3/2}} \right) r$$

12. p. 92: Problems 4-9 and 4-10 are essentially identical. I'm not sure how that happened. Delete 4-10.
13. p. 94: The last term inside the brackets of the equation for A_z in part b of problem 4–15 should have a cosine rather than a sine function.

Chapter 5

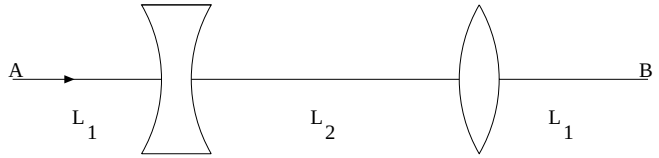
14. p. 96, Eq. (5.1) should read

$$f = \frac{f_{\mathrm{F}}(f_{\mathrm{D}} - l)}{f_{\mathrm{F}} + f_{\mathrm{D}} - l}.$$

15. p. 97, 3rd line after Eq. (5.3): Change "eigenvaluesof" to "eigenvalues of".
16. p. 99, 6th line from bottom: Change "this of solution" to "this solution".
17. p. 112, Problem 5–4, last line: change $\sigma^2_{zz'}$ to $\sigma_{zz'}$.
    p. 113, Problem 5–11, the 2nd conversion formula should be: $\epsilon_{95\%} \simeq 5.991 \epsilon_{\mathrm{rms}}$.

Chapter 6

18. p. 121, Fig. 6.2 should be changed to:



19. p. 128, In Eq. (6.76) and the following line, replace A and B with $\mathbf{A}$ and $\mathbf{B}$.
20. p. 129, 4 lines before Eq. (6.89): The second sentence of the paragraph is wrong. There are some cases of stable matrices with equal tunes and some coupling elements. One example is

$$\mathbf{M} = \begin{pmatrix} \cos\mu & \sin\mu + \frac{a^2}{\sin\mu} & a & 0 \\ -\sin\mu & \cos\mu & 0 & -a \\ a & 0 & \cos\mu & \sin\mu + \frac{a^2}{\sin\mu} \\ 0 & -a & -\sin\mu & \cos\mu \end{pmatrix}.$$

21. p.130, line after Eq. (6.94): Change $\lambda^{-1}\mathbf{M}^{-1}$ to $\lambda^{-1}\mathbf{T}^{-1}$.
22. p. 132, Eq. (6.98) should read

$$\mathbf{T}^{-1} = \begin{pmatrix} \tilde{\mathbf{M}} & \tilde{\mathbf{m}} \\ \tilde{\mathbf{n}} & \tilde{\mathbf{N}} \end{pmatrix} = \begin{pmatrix} f & -b & p & -k \\ -e & a & -n & j \\ h & -d & r & -m \\ -g & c & -q & l \end{pmatrix}.$$

23. p. 137, In Eq. (6.131) Q, $\beta(s)$, and $\eta(s)$ should be replaced by Q_{H}, $\beta_x(s)$ and $\eta_x(s)$, respectively.
24. p. 137, In Eq. (6.132) $\eta(s)$ should be replaced by $\eta_x(s)$.
25. p. 137, In Eq. (6.133) Q should be replaced by Q_{V}.
26. p. 138, The note should be changed to: This result means that there are no "improper" symplectic matrices as there are improper rotations in the rotation group $\mathrm{O}(n)$.

Chapter 7

27. p. 162, Problem 7-3: Replace "γtr" with "$\gamma_{\rm tr}$".
28. p. 162, Problem 7-3: The atomic number of gold is $A = 197$ and not 179.

Chapter 8

29. p. 166, 4 lines before Eq. (8.13) and again 3 lines after Eq. (8.15): Change "loose" to "lose".
30. p. 168, First line: There should not be a bar over the derivative $(dU_\gamma/dU)_s$. (I don't know if this is in all copies. It appears to be a flaw in printing process, since it wasn't in the original electronic files.)
31. p. 169, 3 lines before Eq. (8.37): Change "loose" to "lose".
32. p. 173, Replace the two lines ("In averaging $A\,d(\Delta A)$ over ... becomes") before Eq. (8.63) with "Dropping the second order differentials, Eq. (8.62) combined with Eq. (8.61) yields"
33. p. 176, In Fig 8.2, the three angles should read "$2/\gamma$" and not "2γ".
34. p. 177, Eq. (8.89) should read:

$$\omega \propto \frac{1}{\delta t} \propto \frac{\gamma^3}{\rho}.$$

35. p. 180, In Eq. (8.104), the right-hand side should be

$$\cdots = \frac{1}{c\tau_s} \oint N_\gamma \langle u_\gamma^2 \rangle \, ds.$$

36. p. 186, Problem 8-5: The last part should be labelled "c" not "b".

Chapter 9

37. p. 194, Eq. (9.45): change exponential factor to $e^{i(\omega t - k_g z)}$.
38. p. 203, Eq. (9.95) should be $\tau = 2Q_l/\omega_0$.
39. p. 206, §9.6: Add a reference: J. P. Blewett, Phys. Rev. 88, 1197 (1952).
40. p. 208, §9.7, 2nd line of 2nd paragraph: Add "(recall Fig. 1.9)" after "sine wave".

Chapter 10

41. p. 213, line prior to Eq. (10.5) should read: "and a particular solution of the inhomogeneous equation is".
42. p. 214, In Eq. (10.9) the M_{12} term of the matrix should be "$\beta \sin\mu$".
43. p. 229, Problem 8-2: There should be an additional factor of x in the second term on the left side of the equation.

Chapter 11

44. p. 233, Eq. (11.17) should read:

$$\delta Q_{\rm V} = -\frac{\beta_{\rm V} N r_0}{2\pi B_f \sigma_{\rm V} (\sigma_{\rm H} + \sigma_{\rm V}) \beta^2 \gamma^3}.$$

45. p. 233, 2 lines after Eq. (11.17): Change $\beta^3\gamma^2$ to $\beta^2\gamma^3$.

Chapter 13

46. p. 275, Eq. (13.42) should read:

$$M^\mu{}_\nu = \Lambda(-\delta\vec{\beta}')^\mu{}_\kappa R_x(\theta)^\kappa{}_\nu + \mathcal{O}(\delta\beta^2) = R_x(\theta)^\mu{}_\kappa \Lambda(-\delta\vec{\beta}')^\kappa{}_\nu + \mathcal{O}(\delta\beta^2). \quad 13.42$$

47. p. 284, Eq. (13.106) should read

$$\frac{dS^\mu}{d\tau} = \frac{q}{m}\left[F^{\mu\nu} + \frac{g-2}{2}(F^{\mu\nu} + \beta^\mu F^{\nu\kappa}\beta_\kappa)\right] S_\nu.$$

48. p. 284, Eq. (13.107) should read

$$\frac{dp^\mu}{d\tau} = \frac{q}{m} F^{\mu\nu} p_\nu.$$

49. p. 284, Third line before §13.6, change to: "...an extra term[17] $\vec{\mathcal{P}}' \times \vec{E}$...".
50. p. 296, Eq. (13.191) should read

$$\mathbf{D}^1_{\hat{z}}(\theta) = \begin{pmatrix} \frac{\cos\theta+1}{2} & \frac{i\sin\theta}{\sqrt{2}} & \frac{\cos\theta-1}{2} \\ \frac{i\sin\theta}{\sqrt{2}} & \cos\theta & \frac{i\sin\theta}{\sqrt{2}} \\ \frac{\cos\theta-1}{2} & \frac{i\sin\theta}{\sqrt{2}} & \frac{\cos\theta+1}{2} \end{pmatrix}.$$

51. p. 302, First line should be changed to: Using this with $\vec{E} = 0$, Eq. (13.68) transforms into ...
52. p. 302, The second line of Eq. (31.212) is missing a factor of i.
53. p. 313, In Eq. (13.261) $W_{\uparrow\downarrow}$ should be replaced by $W_{\downarrow\uparrow}$.
54. p. 315, In Problem 13–3, in the Hint, change "applying" to "apply".
55. p. 315, In problems 13–6 and 13–7, the undefined matrices $\mathbf{R}_{\hat{j}}(\cdots)$ should be replaced by spinor rotation matrices $\mathbf{D}^{\frac{1}{2}}_{\hat{j}}(\cdots)$.

Chapter 14

56. p. 323, line before footnote: remove comma at end of line.
57. p. 325, Caption to Fig. 14.6, 2nd line: delete extraneous ")".
58. p. 327, The summation variable in Eq. (14.24) should be m and not i.

Appendix A

59. p. 337, Change first line of §A.9 to "We define the phase slip factor[7]".
60. Reference 7 should be added.

    E. D. Courant, "Computer Studies of Phase-Lock Acceleration", 1961 Int. Conf. on H. E. Accelerators, Ed. M. H. Blewett, Brookhaven National Lab, p. 201 (1961).

    H. Koziol, "Beam Diagnostics for Accelerators", CERN 94-01, v. II, p.565-599 (1994). See page 599.

Appendix D

61. p. 346, Eq. (D.13): Replace N_z with N.

Appendix F

62. p. 359, 7th line from bottom, the 2nd Hankel function is missing an argument of x, i. e. it should read $H^{(2)}(x)$.