ERRATA for *A GENERAL RELATIVITY WORKBOOK* (2nd Printing)

- Page 14, section about defining inertial reference frames: In general relativity, technically one can use the described method to define a *locally* inertial reference frame (that is, a frame that is inertial to a specified accuracy within a sufficiently small region of space and time).
- Page 35, caption to figure 3.2, next-to-last line: the reference to equation 3.18 should be to 3.19.
- Page 42, Problem 3.3: replace three references to 38.7° by 36.87°.
- Page 79, equations 7.4b and 7.4c: Technically, the x, y, and z subscripts should be superscripts.
- Page 109, figure 9.2: The $\Delta\tau$ labeling the interval on the left vertical worldline should be $\Delta\tau_E$.
- Page 117, figure 10.1, left diagram: The horizontal line should be labeled $\tilde{E}$.
- Page 118, second line below equation 10.11: The r^2 should simply be r.
- Page 123, second line above exercise 10.4.3 AND in exercise 10.4.3 itself: change ℓ to $|\ell|$.
- Page 130, figure 11.2: The $\tilde{E}$ label should be next to the *lower* horizontal line, and the *upper* horizontal line should be labeled with an r at its right end.
- Page 227, sentence below equation 19.17: for clarity, change to "At the origin of a LIF, first derivatives of the metric (and thus the Christoffel symbols) are zero, though at least some second derivatives of the metric (and thus first derivatives of the Christoffel symbols) will not be zero."
- Page 230, problem 19.5, change "only non-zero Riemann tensor component" to "only Riemann tensor component that might be nonzero".
- Page 232, fourth paragraph, third line: change "last chapter" to "chapter 18".
- Page 237, box 20.3, first line: Change "moving particles." to "moving particles with mass m."
- Page 237, box 20.3, second paragraph, second line: Delete "mass m and". (The derivation in this box really only works if all particles have the same mass.)
- Page 255, first paragraph, last line: Change "all objects" to "all non-rotating objects".
- Page 256, below equation 22.9: Add (for clarity) "where $\Box^2$ (the four-dimensional del operator) $\equiv \eta^{\alpha\mu}\partial_\alpha\partial_\mu = -\partial^2/\partial t^2 + \nabla^2$."
- Page 263, P22.1, part a, fourth line: change "h_{tt}" to "h_{rr}".
- Page 263, P22.6, part b, first and third lines: replace Φ_G with $\vec{\nabla}\Phi_G$.
- Page 277, P23.5, line before part a: replace $R_{\mu\nu} = T_{\mu\nu} - \frac{1}{2}g_{\mu\nu}T$ with $R_{\mu\nu} = 8\pi G(T_{\mu\nu} - \frac{1}{2}g_{\mu\nu}T)$.
- Page 296, third line below equation 25.14: Change $\sin(\bar{r}/R)$ to $i\sin(\bar{r}/R)$.
- Page 315, below equation 26.25: insert "where t_0 is the present value of t."
- Page 320, equation 27.16: replace L with L_s, to distinguish the luminosity measured in the source frame with L in the previous paragraph, which is the inferred luminosity in the *observer's* frame.
- Page 321, figure 27.3(b): Label the vertical axis "$a(t)$ (unitless)".
- Page 331, third paragraph in the **Photon Decoupling** section, third line: change "directly proportional" to "inversely proportional". Also note that Ta is a constant (see equation 26.10), and T at the present is 2.73 K.
- Page 337, fifth line above exercise 28.5.1: Change ρ_{m0}/m_p to ρ_{b0}/m_p, and add to next line after the close parenthesis ", ρ_{b0} is the normal-matter portion of the current total matter density ρ_{m0},".
- Page 343, third paragraph, fifth line: Change "$\rho \approx$" to "$\rho_r \approx$".
- Page 343, third paragraph, fourth line from the bottom: For clarity change "$t_e \sim [10\cdot\frac{8}{3}\pi G\rho]^{-1/2}$" to "$t_e \sim [\frac{8}{3}\pi G\rho_v]^{-1/2} \sim [10\cdot\frac{8}{3}\pi G\rho_r]^{-1/2}$". Also put a period after "box 29.5)".
- Page 366, Figure 31.1: in each diagram except the one on the upper left, there is one dot outside the ellipse that should be moved to the nearest point on the ellipse.
- Page 367, next-to-last paragraph: This paragraph is seriously out of date! LIGO first detected gravitational waves (from a pair of coalescing black holes) on September 14, 2015 (announced in February of 2016) and has subsequently observed waves from a number of similar events. Leaders of the LIGO experiment won the 2017 Nobel Prize for physics for this triumph.
- Page 367, 2nd and 3rd lines of last paragraph: delete "now renamed the New Gravitational-wave Observatory (NGO)," and replace "which might be launched in the late 2020s" with "which is planned for launch in the 2030s". (The ESA is now formally committed to funding the original LISA proposal, not the somewhat reduced NGO proposal.) Also replace all subsequent instances of "NGO" in this paragraph with "LISA".
- Page 371, equation 31.13*r*: add "= 0" to the end, to make it like equation 31.13.
- Page 371, third line of exercise; change "Lorentz" to "Lorenz".
- Page 385, line below equation 33.5: Change "moment of inertia" to "reduced quadrupole moment". This tensor is sometimes called the "moment of inertia" tensor, but it is different from the tensor of that name in mechanics, and students find this confusing.
- Page 385, equation 33.7: The second term on the right should be negative and be multiplied by G.

(continued)

- Page 386, the first and second lines below equation 33.10c: Change “moment of inertia” to “quadrupole moment” (once in each line).
- Page 386, second line above equation 33.11: change “subtracting the trace from each nonzero element” to “subtracting symmetric fractions of the trace from each remaining nonzero diagonal element”.
- Page 387, equation 33.16: Note that the $\vec{n}$ vectors depend on θ and ϕ, so whatever θ-dependence remains after the integration over ϕ must be carried into the integral over θ. (Some find the notation confusing.)
- Page 391, third line below equation 33.37: Change A^{jk}_{TT} to A^{jk}_{T} (the matrix is transverse, but not yet traceless).
- Page 396, problem P33.9, first line of part **a**: change “moment of inertia” to “quadrupole moment”).
- Page 396, problem P33.9, first line after equation 33.50: change “moment of inertia” to “quadrupole moment”).
- Page 398, next to last line: Change $4GM\eta D^2\omega^2/R_0$ to $-4GM\eta D^2\omega^2/R_0$.
- Page 399, second line: Change “clockwise” to “counterclockwise”.
- Page 405, exercise 34.5.1, 2nd line: Change GM to G$M\omega$.
- Page 411, equation 35.21: change R in the denominator to r to be consistent with previous usage.
- Page 415, equation 35.27: put absolute-value bars around $\sin\theta$.
- Page 415, equation 35.28: put absolute-value bars around $d\phi/d\tau$.
- Page 418, last line of first paragraph: Change “rotating star or black hole” to “rotating black hole”.
- Page 420, section on **Importance of the Kerr Solution**: The Kerr solution applies *only* to black holes, and *not* to the spacetime outside arbitrary axially-symmetric objects. Items 1 and 2 therefore need to be rewritten.
- Page 423, equation 36.18: Change “4” to “6” in all of the initial factors (in each of the four lines), and change the R^2r^2 term (the final term) inside each of the square brackets to $\frac{1}{3}R^2r^2$.
- Page 443, exercise 38.3.1: Delete “Note: Requires numerical integration.”
- Page 448, P38.9, part e, first line: Change “falling object moving” to “falling object with $\ell = 0$ moving”.

(This list does not include some minor typographical errors that are not likely to lead to confusion.)