Gravity: Newtonian, Post-Newtonian, Relativistic
Errors, typographical and otherwise

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The following errors were reported by our faithful readers. They have our boundless gratitude. Emanuele Berti reported a large number of typos before the book was published; the list would be much longer without his invaluable help.

Chapter 1

1. Exercise 1.3, page 61. Each term on the right-hand side of the equation should come with a factor of G.

2. Exercise 1.6, page 61. The left-hand side of the equation should read $\frac{1}{2}d^2I^{jk}/dt^2$.

3. Exercise 1.14, page 62. The left-hand side of the displayed equation should read $e^{\langle pL\rangle}n^{\langle qL\rangle}$ instead of $e^{\langle qL\rangle}n^{\langle pL\rangle}$.

Chapter 2

1. Figure 2.4, page 87. The scale of the vertical axis is actually 10^6 m; meters, not kilometers. Reported by Nico Yunes.

2. Box 2.3, page 113. In the first displayed equation, the first term in the expression for U should be $+GM/r$ instead of $-GM/r$.

3. Equation (2.250), page 118. In the rightmost expression, the number within the square root should be $4\pi/5$ instead of $4\pi/3$. Equation (2.251) is correct. Reported by Nico Yunes.

Chapter 3

1. Equation (3.17), page 145. The quantity $u := 1/r$ introduced a few lines previously should not be confused with the eccentric anomaly u introduced in Eq. (3.30). Reported by Nico Yunes.

2. Equation (3.85c), page 165. The expression for $\langle\Delta\omega\rangle$ presents us with a paradox, because it doesn't reduce to Eq. (3.83) when $\iota = 0$, that is, when the perturbing body moves in the same plane as the binary system. The coplanar case is treated in Sec. 3.4.1, where we point out that since the line of nodes is not defined in this case, Ω is redundant and can be set equal to zero. With this convention, ω is the angle between the pericenter and the fixed X-direction. Our convention is different in Sec. 3.4.2, since ω now refers to the line of nodes, which is itself moving with respect to the fixed X-direction. And as we point out in Sec. 3.3.2 below Eq. (3.67), the motion of the pericenter relative to the fixed X-direction is properly captured by $d\omega + \cos\iota\, d\Omega$. The quantity, therefore, that should be compared

with the $\langle\Delta\omega\rangle$ of Eq. (3.83) is $\langle\Delta\omega\rangle + \cos\iota\langle\Delta\Omega\rangle$ in the limit $\iota \to 0$, with $\langle\Delta\omega\rangle$ now standing for the expression of Eq. (3.85c). An expression for $\langle\Delta\Omega\rangle$ is not provided in Sec. 3.4.2, but a simple computation returns

$$\langle\Delta\Omega\rangle = -\frac{3\pi}{2}\frac{m_3}{m}\left(\frac{a}{R}\right)^3 (1-e^2)^{-1/2}\cos\iota\big(1+4e^2-5e^2\cos^2\omega\big).$$

With this we get

$$\langle\Delta\omega\rangle + \cos\iota\langle\Delta\Omega\rangle = \frac{3\pi}{2}\frac{m_3}{m}\left(\frac{a}{R}\right)^3 (1-e^2)^{1/2}\big[(4-5\cos^2\omega)\cos^2\iota + 5\cos^2\omega - 3\big],$$

and we see that this does indeed reduce to the $\langle\Delta\omega\rangle$ of Eq. (3.83) when $\iota = 0$. The paradox was reported by Katerina Chatziioannou and Nico Yunes, who helped us resolve it.

3. Box 3.4, page 171. Our discussion of DI Herculis is out of date. A plausible explanation for the discrepancy between the observed and calculated apsidal advance was proposed by S. Albrecht, S. Reffert, I. A. G. Snellen, and J. N. Winn, *Misaligned spin and orbital axes cause the anomalous precession of DI Herculis*, Nature **461**, 373–376 (2009). We thank Scott Hughes for pointing out this reference.

4. Exercise 3.3, page 185. The modified Poisson equation should read $(\nabla^2 - \lambda^{-2})U = -4\pi G\rho$. Reported by Nicholas Loutrel.

5. Exercise 3.4 (c), page 185. The expression for C should be $C = h^2 - J_2R^2[\cdots]$; there is a relative minus sign between the terms.

6. Exercise 3.9 (c), page 187. First, the label should be (c) instead of (b), but you knew that, didn't you? Second, the length of the day should come out to 47 days instead of 48.

Chapter 6

1. Exercise 6.4, page 326. The expression for J^{jk} is incorrect. It should be replaced with

$$J^{jk} = -\frac{c^3}{16\pi G}\oint_\infty r^4\frac{\partial}{\partial r}\left(\frac{x^j h^{0k} - x^k h^{0j}}{r^2}\right) d\Omega.$$

Chapter 7

1. Equation (7.52c), page 346 and Eq. (7.53), page 347. The scaling of $(16\pi G/c^4)(-g)t_{\rm H}^{jk}$ is c^{-8} instead of c^{-6}. This can be seen by inserting $h^{00} \propto c^{-2}$ and $h^{jk} \propto c^{-4}$ in the expression of Eq. (7.53), and noticing that the ∂_{00} operator brings an additional factor of c^{-2}. The error term in Eq. (7.53) is therefore of order c^{-10} instead of c^{-8}. Reported by Alain Dirkes.

Chapter 8

1. Equation (1), Box 8.1, page 377. The term $v^2\boldsymbol{\nabla}g_s$ within brackets should read $\frac{1}{2}v^2\boldsymbol{\nabla}g_s$.

2. Exercise 8.2, page 411. The term $v^2\boldsymbol{\nabla}g_s$ within brackets should read $\frac{1}{2}v^2\boldsymbol{\nabla}g_s$.

3. Exercise 8.3, page 411. The expression for $\bar{g}_{00}$ should read

$$\bar{g}_{00} = g_{00} - \frac{2\lambda}{c^4}\big(\bar{U}^2 + \bar{\Phi}_2 + \bar{\Phi}_W\big).$$

4. Exercise 8.8, page 413. The bracketed term on the second line should read $4U^{k]} + \frac{1}{2}\partial_t^{k]}X$.

Chapter 10

1. On the second line of page 492, the averaged rate of advance of the line of nodes of the lunar orbit should be 1.91 arcseconds per century, not 19.1.

Chapter 11

1. Equation (11.137), page 571. The domain of integration should be $\partial\mathscr{M}_y$ instead of $\mathscr{M}_y$. Reported by Alain Dirkes.

Chapter 12

1. Equation (12.46), page 647. The factor of c^3 on the right-hand side should be c^2. Reported by Nico Yunes.

2. Equation (12.56), page 640. In the first line of the equation, the first term on the right-hand side should contain a factor of c^{-1}. We can perhaps be forgiven for this one, because this term vanishes anyway. Reported by Emanuele Berti.

Chapter 13

1. Equation (13.38a), page 719. On the right-hand side of the equation, the final term should read $-\alpha_3 n_{AB}^{\langle jl\rangle}(w+v_B)^k \hat{S}_B^{lk}$ instead of $-\alpha_3 n_{AB}^{\langle jl\rangle}(w+v_B)^p \hat{S}_B^{lk}$; the index on $(w+v_B)$ should be k instead of p.

2. Equation (13.63), page 726. The Δ that appears in this equation should be defined by $\Delta := (M_2 - M_1)/(M_1+M_2)$ instead of the relation provided below the equation. This new definition does not agree with our previous usage. The redefinition is localized to Sec. 13.3.3 only, and it impacts Eqs. (13.63), (13.66), (13.71), and (13.72).

3. Equation (13.72), page 728. Our expression for $\delta r(t)$ is not complete. It omits a number of terms that are either constant or proportional to $\cos(\omega_\oplus t \pm n\Phi)$, where $n = \{0, 1, 2, 3\}$. Collectively, these terms represent an eccentricity perturbation superposed to our initially circular ($A = B = 0$) orbit.

4. Equations (13.132)–(13.134), page 745. The pseudotensors $t_\phi^{\alpha\beta}$, $t_{\rm LL}^{\alpha\beta}$, and $t_{\rm H}^{\alpha\beta}$ should all be adorned with tildes: $\tilde{t}_\phi^{\alpha\beta}$, $\tilde{t}_{\rm LL}^{\alpha\beta}$, and $\tilde{t}_{\rm H}^{\alpha\beta}$. Reported by Nico Yunes.