

Errata for Gravity: An Introduction to Einstein's General Relativity, *Printings 1-3*

Updated 3/24/2004

This is a list of errata that were not corrected in the third printing, and which therefore do not appear on earlier lists. Thanks are due to J. David Brown, Dan Crow, John Friedman, Katherine Holley, Matt Lehman, Mario Serna, Robert Nelson, Steve Savitt, and Chester Vause who supplied most of these.

54, *Figure 4.7*: Replace “paths of the light pulse travels” with “path the light pulse travels”.

62, *Equation 4.13a*: Replace $(dx^2 + dy^2 + dx^2)$ with $(dx^2 + dy^2 + dz^2)$.

73, *Problem 4*: Replace “orbits the Earth” with “orbits the Earth in the same direction it rotates”. (Clearer.)

74, *Problem 9*: Replace “Consider two twins” with “Consider twins...”

101, *Problem 5.17*: Replace this problem with the following (same problem but better notation):

[C] (*Relativistic Beaming*) A body emits photons of frequency ω_* at equal rates in all directions in its rest frame. A detector at rest in this frame a large distance away (compared to the size of the body) receives photons at a rate per unit solid angle $(dN/dtd\Omega)_*$ [photons/(s · sr)] that is independent of direction. In an inertial frame (t', x', y', z') in which an observer is at rest the body is moving with speed V along the x' – axis.

1. Derive (5.75) relating a photon's direction of propagation in the rest frame to the direction of propagation in the observer's frame.
2. Find the rate at which photons are received per unit solid angle $dN/dt'd\Omega'$ a large distance away in the observer's frame as a function of angle α' from the x' –axis.
3. Find the luminosity per unit solid angle $dL'/d\Omega'$ [erg/(s · sr)] a large distance away as a function of the angle α' in the observer's frame.
4. Discuss the beaming of number and energy in the observer's frame as the velocity of the source approaches the velocity of light.

115, 12 from bottom: Replace “... but in which V/c and gh/c may ...” with “... but in which V/c and gh/c^2 may ...”

119, first paragraph: Replace “derived in Example 6.3..” with “derived in Example 6.2...”.

130, Box 6.2: The picture is not of Hafele and Keating and not of their clocks. It is of two USNO technicians, George Luther (left) and Bill Dabney (right) boarding similar clocks on an airplane for another purpose. A correct picture of Hafele and Keating on their initial flight is below.



Hafele and Keating on board with their clocks.

Thanks to Robert Nelson of the Satellite Engineering Research Corporation for pointing out this error and supplying the correct picture.

143, caption to Figure 7.1: Insert “future” before “light cones”. (clearer).

145, caption to Figure 7.2: Replace “Inside the light cones...” with “Inside the future light cones...” (clearer).

146, equation 7.28: The middle expression should be $d\ell^1 d\ell^2$ not $d\ell^2 d\ell^3$.

191, after 9.18: Replace “evaluated at a Schwarzschild radius R .” with “evaluated at the radius $r = R$ in Schwarzschild coordinates.”

- 202, *Figure 9.5*: The M in the axis label ℓ/M should be italic like the rest of math so its ℓ/M .
- 207, *Figure 9.8*: The vertical axes should be labeled W_{eff} in three places, not V_{eff} .
- 207, *caption to Figure 9.8*: “heavy doted lines” should be “heavy dotted lines”.
- 216, *Problem 12*: Replace “around a relativistic star” with “around a relativistic star of mass M ”. (clearer)
- 218, *Problem 21*: Replace the sentence beginning “Explain why ...” with “ Explain why and *estimate* the angle measured from the line of sight on the far side above which the surface could be seen. This would be $\pi/2$ if there were no bending, but less than that because of the bending.” (This definition of angle is clearer than “latitude”.)
- 233, *table in Problem 5*: In the bottom line of the fourth column 1.00 should be 1.000 .
- 238, *5l from bottom*: Replace “is beautiful” with “is a beautiful”.
- 249, *Figure 11.8*: After “.... July 1994” insert “(Tanaka et.al. 1995).”
- 259, *16 from bottom*: Replace “Light cones at ...” with “Future light cones at ...”.
- 264, *caption to Figure 12.4*: Replace “orientations of light cones...” with “orientations of future light cones...” (clearer).
- 266, *Box 12.3*: 4th paragraph, delete “generic” in two places.
- 271, *caption for Figure 12.6*: Replace “a few light cones are indicated...” with “a few future light cones are indicated...”
- 278, *Problem 13*: “For instance can she ever see her feet when her head ...” should be “For instance, can she see her feet when her head ...” . (ie delete “ever” in this sentence but leave it in the other two.)
- 350, *caption for Figure 17.3*: Replace ‘Fixen’ by ‘Fixsen’.
- 390, *11-2 of text*: The formula in the sentence beginning “Their total...” is off by a factor of 2. The sentence would should read: “The total duration is therefore $(\pi\Omega/H_0)(\Omega - 1)^{-3/2}$. ”

449, Eq. (21.9): The last equation should for $\chi^{\hat{\phi}}$ have a minus in front of M/r^3 on the right hand side, ie so its:

$$\frac{d^2\chi^{\hat{\phi}}}{dt^2} = -\frac{M}{r^3}\chi^{\hat{\phi}}$$