Introduction to Cosmology
Second Edition
Errata

Barbara Ryden

2022 Jun 14

These errors have been noted by keen-eyed readers of *Introduction to Cosmology*. If you spot more mistakes in the book, contact the author (ryden.1@osu.edu). The pagination and equation numbers below are those of the second edition (Cambridge University Press, ©2017). Thanks to Stan Ferguson, Orin Harris, We-Fu Chang, Adam Rengstorf, Neil Comins, and William Joyce for pointing out where I was wrongedy-wrong-wrong.

Equation (2.4) has an extraneous factor of 4π. It should read

$$\Omega = \frac{\pi R_\star^2}{r^2}. \tag{2.4}$$

This error propagates into Equation (2.6), which should be

$$\Sigma_\star = \frac{f}{\Omega} = \frac{L_\star}{4\pi^2 r^2}. \tag{2.6}$$

The surface brightness of the Sun (cited in the paragraph after Eq. 2.6) should then be $\Sigma_\odot \approx 5 \times 10^{-4}\,\mathrm{watts\,m^{-2}\,arcsec^{-2}}$. This is bigger by a factor of 10 trillion (not the printed "100 trillion") than the surface brightness of the night sky.

Equation (3.20) squares two terms that should not be squared. The correct equation is

$$\begin{aligned}(\Delta s')^2 = &-\gamma^2 \left[c(t_1 - t_2) - \frac{v}{c}(x_1 - x_2)\right]^2 \\ &+ \gamma^2[x_1 - x_2 - v(t_1 - t_2)]^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2].\end{aligned} \tag{3.20}$$

Equation (5.45) is missing a factor of G. It should be

$$\varepsilon_0 = \varepsilon_{c,0} = \frac{3c^2}{8\pi G} H_0^2 = \frac{c^2}{6\pi(1+w)^2 G} t_0^{-2}. \tag{5.45}$$

Equation (5.64) has a factor of π^2 where there should be a factor of π^3. The correct equation is

$$T(t) = \left(\frac{45}{32\pi^3}\right)^{1/4} T_P \left(\frac{t}{t_P}\right)^{-1/2} \approx 0.46 T_P \left(\frac{t}{t_P}\right)^{-1/2}. \tag{5.64}$$

The resulting error of $\pi^{1/4} \approx 1.33$ propagated into Equations (5.65), (5.66), and (5.69). The correct equations are

$$E_{\text{mean}}(t) \approx 2.7kT(t) \approx 1.25 E_P \left(\frac{t}{t_P}\right)^{-1/2}, \tag{5.65}$$

$$n(t) = \frac{\varepsilon_r(t)}{E_{\text{mean}}(t)} \approx \frac{0.024}{\ell_P^3} \left(\frac{t}{t_P}\right)^{-3/2}, \tag{5.66}$$

and

$$N(t) = V_{\text{hor}}(t) n(t) \approx 0.8 \left(\frac{t}{t_P}\right)^{3/2}. \tag{5.69}$$

In addition, the sentence after Equation (5.69) should read "The quantization of the universe can no longer be ignored when $N(t) \approx 1$, equivalent to a time $t \approx 1.2 t_P$" (corrected from "$t \approx 1.4 t_P$").

The x-axis of Figure 5.7 is mislabeled "-4, -2, 0, 0, 0" instead of the correct "-4, -2, 0, 2, 4".

An extra factor of c^3 infiltrated Equation (8.25). The correct equation is

$$n_x(p)dp = g_x \frac{4\pi}{h^3} \exp\left(\frac{-m_x c^2 + \mu_x}{kT}\right) \exp\left(-\frac{p^2}{2m_x kT}\right) p^2 dp. \tag{8.25}$$

On page 249, line 5, the sentence "The helium mass fraction is $X = 0.72$." should read "The hydrogen mass fraction is $X = 0.72$."