Serjeant, Observational Cosmology (2010)

Page 14

In the paragraph directly above Worked Example 1.1, the second sentence from the end should say "Freely falling particles move on paths for which the total interval *s* is a *minimum* along that path ..."

Page 43

The equation below Equation 2.2 should read

$$I(\nu', T)\mathrm{d}\nu'(1+z) \propto \frac{(\nu')^3(1+z)^3}{\mathrm{e}^{h\nu'(1+z)/kT}-1}\mathrm{d}\nu'(1+z)$$

but since the $(1+z)$ factors on each side immediately cancel out, the rest of the derivation is unaffected.

Page 58

Equation 2.18 should read:

$$\ddot{\phi} + 3H\dot{\phi} - \nabla^2\phi + \mathrm{d}V/\mathrm{d}\phi = 0$$

(i.e. the first '=' sign as printed should be a '+')

Page 73

The redshift value in the third line of Exercise 2.9 should read "$z \simeq 24\,000\Omega_{\mathrm{m},0}h^2$". This does not affect the answer.

Page 76

Just above Figure 2.12, the sentence about optical depth should say: "...the probability of a photon undergoing Thomson scattering is defined as $1 - \mathrm{e}^{-\tau}$"

Page 76

The x-axes of the two panels in Figure 2.12 should read "redshift of reionization".

Page 88

In lines 4 & 5, the text should say "...120 orders of magnitude *greater* than the observed Λ."

Page 161

End of line 8/beginning of line 9 should read "... at some observed frequency P_0..." (and not wavelength).

Page 168

Third line from the bottom, the expression for P_{rest} should be $P_{\mathrm{rest}} = P(1 + z)$.

Page 186–187

Towards the bottom of p.186 and in Equation 6.7 at the top of p.187, replace $\frac{\mathrm{d}M_{\mathrm{BH}}}{\mathrm{d}t}$ with $\frac{\mathrm{d}M_{\mathrm{acc}}}{\mathrm{d}t}$, i.e. the rate of mass accretion, not the rate of growth of black hole mass. Note therefore that the fraction of the accretion rate which goes into increasing the mass of the black hole is $(1-\eta)$, and so the rate of growth of the mass of the black hole is therefore $\frac{\mathrm{d}M_{\mathrm{BH}}}{\mathrm{d}t} = (1-\eta)\frac{\mathrm{d}M_{\mathrm{acc}}}{\mathrm{d}t}$.

In the paragraph below Equation 6.8, delete everything after the first sentence and replace it with the following:

"If we set $L_{\mathrm{E}} = \eta\frac{\mathrm{d}M_{\mathrm{acc}}}{\mathrm{d}t}c^2$, we can re-write this as $L_{\mathrm{E}} = \frac{\eta}{(1-\eta)}\frac{\mathrm{d}M_{\mathrm{BH}}}{\mathrm{d}t}c^2$.

Then, given the definition of the Eddington timescale in Equation 6.8, we can combine these two equations to give $\frac{\mathrm{d}M_{\mathrm{BH}}}{\mathrm{d}t} = \frac{(1-\eta)}{\eta}\frac{M_{\mathrm{BH}}}{t_{\mathrm{E}}}$.

This differential equation has a solution $M_{\mathrm{BH}} \propto \exp\left[\left(\frac{1-\eta}{\eta}\right)\frac{t}{t_{\mathrm{E}}}\right]$.

So the e-folding timescale for growth of the black hole, i.e. the time to increase by a factor of e = 2.71828..., is $\eta t_{\mathrm{E}}/(1-\eta)$."

Page 192

Equation 6.19 should read $\frac{r^2}{c}\frac{\mathrm{d}\phi}{\mathrm{d}\tau} = \mathrm{constant} = \frac{J}{mc} = \tilde{J}$

Page 193

In Equation 6.25 the integral is not separable and should therefore read:

$$E_{\mathrm{total}} = \frac{4\pi}{c}\int\limits_{z=0}^{\infty}\int\limits_{S=0}^{\infty}(1+z)Sn(S,z)\mathrm{d}z\mathrm{d}S$$

Page 195

Equation 6.29 should read $r_h = \frac{GM_{\mathrm{BH}}}{\sigma^2} \simeq 10\left(\frac{M_{\mathrm{BH}}}{10^8\ \mathrm{M}_\odot}\right)\left(\frac{\sigma}{200\ \mathrm{km\ s^{-1}}}\right)^{-2}\ \mathrm{pc}$.

Then the paragraph following Equation 6.30 should say "...so the radius r_h is about 10^6 times bigger than the Schwarzschild radius .... if we can reach angular resolutions of $\sim 10^6 R_{\mathrm{S}}$ we may be able to..."

Page 201 and page 307

In Exercise 6.6, add a phrase to the end of the question as follows "...you still cannot create a supermassive black hole by $z=2$ through Eddington-limited black hole growth, if it is accreting with maximal efficiency, $\eta = 0.42$."

Change the solution to Exercise 6.6 as follows: "The e-folding timescale for Eddington-limited black hole growth is $t_{\mathrm{e-fold}} = 4 \times 10^8 \times \eta/(1-\eta)$ years. There have been $3 \times 10^9 / t_{\mathrm{e-fold}}$ e-foldings since the start of the Universe, or $7.5 \times (1-\eta)/\eta$ e-foldings. To reach $10^6 \mathrm{M}_\odot$, one needs $\log_e(10^6/10^1) = 11.5$ e-foldings. If , there is only time for 10.4 e-foldings. In order to grow a black hole large enough, it must be spinning more slowly, and therefore have a lower accretion efficiency."

Page 207

About mid-way down the page, the "broad constraint on the accretion efficiency" should be $\eta = 0.04 - 0.16$.

Page 226

In Equation 7.20, the force vector ***F*** should be given by $(-kx, -ky)$.

Page 231

The equation at the top of the page should read $n = \sqrt{\frac{1-2\Phi/c^2}{1+2\Phi/c^2}} \simeq 1 - \frac{2\Phi}{c^2}$

Page 234

The right-hand side of Equation 7.46 should read *a* + *d* (not *ad*).

Page 235

In Figure 7.17, the pair of schematics at the top of the middle column is not quite correct. To get the effect shown it should have the centre of the little circle (i.e. the position of the background object) just outside the apex of the star-shaped inner caustic.

Page 242

Equation 7.57 should read:

$$1 - \kappa = \frac{1}{2}(\mathrm{tr}\, A) = 1 - \frac{1}{2}(\psi_{11} + \psi_{22})$$

Page 261

In the line directly below Figure 8.9 it should refer to the 'red' line (not dotted).

Page 273

The second sentence of the last paragraph of Section 8.9 should read: "Figure 8.19 shows the constraints on the neutral fraction (1 - *x*) ... ".

Page 303

In the solution to Exercise 4.13, the expression for n_{wide} should include the constant of proportionality k (as in the expression for n_{pencil}) so that it then cancels out when the two expressions are compared.

The last paragraph should say "...if the source counts are steeper than $N(>S) > S^{-2}$, then the pencil-beam survey would see more."

Page 306–307

The first sentence of the solution to Exercise 6.5 should read 'The angular radius ... ' (not angular size).

In the solution to Exercise 6.5, inserting numbers into Equation 6.29 should give: $r_h = 10 \times (10^8/10^8) \times (220/200)^{-2}$ pc $= 8.3$ pc. This then gives an angular radius of $\theta \simeq 8.3 \times 10^{-7}$ radians or $\theta \simeq 0.17''$. It is still the case that this is smaller than the seeing limit of ground based telescopes.

Immediately after the solution of 0.17", add the phrase '(or double that for the diameter)'.