\*原地址：<http://www.astro.wisc.edu/~sparke/book/errata.html>

**Galaxies in the Universe: errata for the second edition**

"As the camera-ready book goes to press, it is completely free of any typographical errors, errors of physics, or errors of judgement. Any errors present in the final product must have crept in during the production process, and are wholly the fault of the publisher."
E.W. Kolb and M.S. Turner, preface to the 1990 edition of 'The Early Universe', Addison-Wesley

"The questions used ... have been painstakingly researched. However, the answers have not."
Michael Feldman's 'Whad'Ya Know?' (Quiz show, Wisconsin Public Radio)

Please let us know by e-mail, at sparke\_at\_astro.wisc.edu or jsg\_at\_astro.wisc.edu, if you find errors in 'Galaxies in the Universe' that are not already listed below. Many thanks for your help!

**Chapter 1: Introduction**

Equation 1.9 on page 12 gives stellar lifetimes in units of 1Gyr, not 10Gyr; it should read log(τMS/1Gyr) = 1.015... and not log(τMS/10Gyr) = 1.015...
On page 25, in Problem 1.7 the reference to Table 1.2 and 1.4 should instead be to Tables 1.4 and 1.5. Problem 1.8 should refer to Table 1.6, not to Table 1.4.
In Problem 1.9 on page 30, the thermal speed of hydrogen atmos at T=100K is about 1.6km/s, so the factor on the right side of Equation 1.18 is close to 2300, rather than 3000.
In Problem 1.11 on page 34, the correct value for κ is 0.0084. Light is reduced to 1/e (37%) of its original intensity after traveling though about 120cm of gas.
On page 42, the units of surface brightness in Equation 1.23 are W m-2 per steradian. In practice, astronomers usually express surface brightness either as the apparent magnitude of a star that is as bright as one square arcsecond on the sky, or as the number of sunlike stars per square parsec that are required to give the observed amount of light. Problem 1.14 shows how to convert between these two measures.
In Problem 1.17 on page 51, a factor 4π should multiply the expression in Equation 1.35.
Also on page 51: to create a particle pair, the energy of a pair of photons must exceed 2mc2 in the rest-frame where their momenta add to zero. For a pair of photons in blackbody radiation at temperature T, that energy averages close to 3.2kBT (thanks to Carlo del Noce for doing the integrals!) so proton-antiproton pairs will be produced easily when kBT > mpc2.
In Problem 1.18 on page 53, kBT = 70keV at roughly t=350s, rather than t=365s. (The curious may wonder why this energy is so much lower than the binding energy of deuterium. Because there are more than 109 photons for each neutron or proton, a deuterium nucleus is quickly smashed apart by more-than-averagely-energetic photons until the temperature falls well below its binding energy.)
In Problem 1.19 on page 54, the mass-to-light ratio must exceed 30 h-1 in solar units (not 50 h-1). This is significantly larger than the ratio we will find for the Milky Way in Problem 2.19.

**Chapter 2: Mapping our Milky Way**

* [PDF update for Table 1.7 (atomic forbidden lines)](http://www.astro.wisc.edu/~sparke/book/errata/table1-7.pdf)
* [PDF update for Table 1.8 (molecular lines)](http://www.astro.wisc.edu/~sparke/book/errata/table1-8.pdf)

In Problem 2.7, the dimensions of the ring around supernova 1987a should be 1.62arcsec x 1.18arcsec, not 1.62arcsec x 1.10arcsec as given.
Problem 2.10 should begin "Near the Sun, thin-disk stars make up 90% of the total in the midplane...".
At the end of Section 2.2.3, on page 86: in Table 2.1, we see that the halo stars near the Sun have σR < σφ,z. The outer-halo stars have larger random motions in the direction towards the Galactic center than in the tangential directions: in spherical coordinates (r,θ,φ) centred at the Galaxy center, we observe σr > σθ,φ. But Table 2.1 does not contain this information.
In Problem 2.23 on page 104, the timescale for a hydrogen atom to collide with a grain is 1Gyr x (1 cm-3/ nH), or 10Myr x (100 cm-3/ nH). The last part of the problem then works out correctly.
In Problem 2.24 on page 105, the first term in the expression for S\* is missing a factor of π; it should be should be (4 π r3/3) and not (4 r3/3). The radius r\* is then 0.7pc, and the ionized mass roughly 40 Msun. The B star ionizes a volume only 3% as large, and r\*=0.23pc.
In Equation 2.24 on page 108, the molecular weight of a gas which is 75% molecular hydrogen and 25% helium by mass is roughly μ=2.3. The Jeans mass at T=10K for a density n=100 cm-3 is about 30 solar masses, rather than 20 solar masses.

**Chapter 3: The Orbits of the Stars**

In Problem 3.7 on page 117, the reference to Figure 7.16 should instead be to Figure 8.16.
On page 122, just below Problem 3.13, a better statement would be "The core radii of open clusters are generally a few parsecs (Table 2.2)." The reference to the homogeneous sphere of Problem 3.1 should instead be to Problem 3.11.

**Chapter 5: Spiral and S0 Galaxies**

At the start of Section 5.2.1 we could have included this derivation of the diffraction limit: a telescope of diameter D observing at wavelength λ cannot separate sources that are closer on the sky than θ = λ/D.
A photon's momentum in the direction of travel is hν/c or h/λ. When its path makes a small angle θ to the axis of the telescope mirror, its momentum has a component hθ/λ parallel to the mirror. If the photon falls on the telescope mirror, the uncertainty in its position in the parallel direction cannot be less than D. So quantum physics tells us that this component of its momentum is not known to better than h/D, where h is Planck's constant. So if we measure λ with high precision, θ cannot be measured to better than λ/D. [From V. Radhakrishnan in 'Synthesis Imaging in Radio Astronomy II', ASP Conf. Proc. 180, 1999]
In Problem 5.13 on page 231, the zone in which two-armed spiral waves can persist is roughly three times larger than that for four-armed spirals: the ratio is close to (5.8/2.1). The reasoning in the hint on page 419 is correct.

**Chapter 6: Elliptical Galaxies**

On page 270, in the left panel of Figure 6.20 the absolute magnitude scale on the horizontal axis should run from -16 to -24, not +16 to +24. The version on the web page is correct.

**Chapter 7: Galaxy Groups and Clusters**

The first sentence of the second paragraph should read 'Groups and clusters are...', not 'Galaxies and clusters...'
On page 282, in Equation 7.2 the quantity Λ should have units erg cm3 s-1. A better version of this equation would read "If each cubic centimeter contains n atoms, the luminosity of a volumne V is LX = V n2 Λ(TX) ..." In Figure 2.25, recall that cooling at T<107K is largely from spectral lines emitted by atoms.
On page 297, the last sentence of Problem 7.8 should refer to the result of Problem 3.12, not Problem 3.11.
On page 298, the last term of Equation 7.12 is upside down: it should read (T/107K)1/2, not (107K/T)1/2.

**Chapter 8: The Large-scale Distribution of Galaxies**

In Equation 8.25 on page 331, the left side is missing a minus sign: it should be - k c2/R2(t0).
On page 333, in Section 8.2.1, in the fourth sentence of the opening paragraph, delete "z - Δz" to read 'Light from another galaxy at a slightly smaller redshift must have been emitted later by a small interval...'
In the equation for te between Equations 8.33a and 8.33b, a prime is missing: the quantity in the square root should be (1 + Ω0z') instead of (1 + Ω0z).
In Section 8.3.3, on page 343, the sentence following Equation 8.48 should read 'The right panel of Figure 8.8...', not 'left panel'

**Chapter 9: Active Galactic Nuclei and the Early History of Galaxies**

In Section 9.1.3 we messed up the conversion between cgs and SI electromagnetic units. In a vacuum, 1 tesla = 104G, not 106G.
So on page 379, Equation 9.9 should read νc = 1.5 γ2 νL = 4.2 γ2 B/(1G or 10-4T) MHz.
In Equations 9.12 and 9.13 for the half-energy-loss time t1/2, 10-11T should be replaced by 1nT (nanotesla).
In the closing paragraph of Section 9.1.3, the field strength in giant radio lobes is 0.1-1 nT, not 10-11-10-12T. Thanks to John Wardle for spotting this!
In Problem 9.5 on page 382, the mass within the orbiting molecular gas ring is 5 x 1010Msun, ten times larger than is given in the text. Thanks to Kirsten Kraiberg Knudsen!