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# Physics of the Interstellar and Intergalactic Medium

Errata in the second and third printings.

Updated 2018.04.09

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### Errata in the second and third printings.

- Plate 5 caption, typo:  
...seen in Plate 6. → ...seen in Plate 4.  
noted 2018.04.07 by L. Bouma.
- §1.2, p. 8, Table 1.4: change abundance of P from  $N_P/N_H = 3.23 \times 10^{-7 \pm 0.03}$ ,  $M_P/M_H = 1.00 \times 10^{-5}$  to  $N_P/N_H = 2.82 \times 10^{-7 \pm 0.03}$ ,  $M_P/M_H = 8.73 \times 10^{-6}$   
noted 2013.10.21 by Bon-Chul Koo.
- §3.6, p. 28, Eq. 3.31, typo: factor of 2 error. Eq. (3.31) should read

$$\sigma_{rr,ul}(E) = \frac{1}{2} \frac{g(X_\ell)}{g(X_u^+)} \frac{(I_{X,\ell u} + E)^2}{Em_e c^2} \sigma_{pi,\ell u}(h\nu = I_{X,\ell u} + E) \quad , \quad (3.31)$$

noted 2015.06.01 by E. B. Jenkins

- §3.7, p. 28, Eq. (3.33), typo: sign error. Change  $e^{-I_n/kT} \rightarrow e^{I_n/kT}$ .  
noted 2017.02.09
- §5.2.2, p. 50, 3rd paragraph, typos: change  
para-H<sub>2</sub>O must have  $K_{-1} + K_{+1}$  odd →  
para-H<sub>2</sub>O must have  $K_{-1} + K_{+1}$  even  
and  
ortho-H<sub>2</sub>O must have  $K_{-1} + K_{+1}$  even →  
ortho-H<sub>2</sub>O must have  $K_{-1} + K_{+1}$  odd  
noted 2015.01.15 by Neal Evans.
- §8.3, p. 74, Eq. (8.26), typos:  $T_A^{\text{on}}(v) \rightarrow T_A^{\text{off}}(v)$  (two occurrences).  
noted 2013.02.14 by Munan Gong.
- §9.10, Table 9.4, p. 88, typos: for C II and N III, change  ${}^2D_J^o \rightarrow {}^2D_J$  for  
 $J = 3/2$  and  $J = 5/2$ .  
noted 2015.02.12 by Semyeong Oh.
- §11.4, p. 110, Eq. (11.35) should read

$$\nu \ll \frac{e^2 (\Delta n_e)_{L,\text{rms}}}{2\pi m_e c} (2LD)^{1/2} = 1 \times 10^3 \text{ GHz} \frac{(\Delta n_e)_{L,\text{rms}}}{10^{-3} \text{ cm}^{-3}} \left( \frac{L}{10^{14} \text{ cm}} \frac{D}{\text{kpc}} \right)^{1/2} .$$

noted 2013.02.03 by W. Vlemmings.

- §12, p. 121, Table 12.1, typos:  

CMB, $T = 2.725$ K	:	$4.19 \times 10^{-13}$	→	$4.17 \times 10^{-13}$
$T_2 = 4000$ K, $W_2 = 1.65 \times 10^{-13}$	:	$3.19 \times 10^{-13}$	→	$3.20 \times 10^{-13}$
$T_3 = 7500$ K, $W_3 = 1 \times 10^{-14}$	:	$2.29 \times 10^{-13}$	→	$2.39 \times 10^{-13}$
Starlight total	:	$1.05 \times 10^{-12}$	→	$1.06 \times 10^{-12}$
ISRF total	:	$2.19 \times 10^{-12}$	→	$1.98 \times 10^{-12}$ .

noted 2012.11.08

- §12.5, p. 123, below eq. (12.4): change  
 ... $W_1$  by 40%, from  $W_1 = 5 \times 10^{-13}$  to  $7 \times 10^{-13}$ . →  
 ... $W_1$  by 75%, from  $W_1 = 4 \times 10^{-13}$  to  $7 \times 10^{-13}$ , and raised  $W_2$  from  
 $1.0 \times 10^{-13}$  to  $1.65 \times 10^{-13}$ .  
 noted 2014.11.11 by S. Bianchi.

- §13.1, pp. 128, eq. (13.1), (13.3), (13.4): for notational consistency with the rest of the chapter, change  $\sigma_{pe} \rightarrow \sigma_{pi}$   
 noted 2018.01.07 by L. Bouma.

- §13.1, p. 130, second paragraph, typo:  
 ...to  $3 \times 10^{-10} \text{ s}^{-1}$  for Si → ...to  $3 \times 10^{-9} \text{ s}^{-1}$  for Si  
 noted 2017.03.05

- §14.6, p. 154, Table 14.8 update: replace  
 $\text{H}_3^+ + e^- \rightarrow \text{H}_2 + \text{H}$   $1.1 \times 10^{-7} T_2^{-0.56}$  McCall et al. (2004)  
 with  
 $\text{H}_3^+ + e^- \rightarrow \text{H} + \text{H} + \text{H}$   $8.9 \times 10^{-8} T_2^{-0.48}$  McCall et al. (2004)  
 $\text{H}_3^+ + e^- \rightarrow \text{H}_2 + \text{H}$   $5.0 \times 10^{-8} T_2^{-0.48}$  McCall et al. (2004)  
 noted 2013.04.03

- §14.9, p. 159, typo: factor of 2 error. Eq. (14.41) should read

$$\sigma_{rr}(E) = \frac{g_l}{2g_u} \frac{(I+E)^2}{Em_e c^2} \sigma_{pi}(h\nu = I+E) . \quad (14.41)$$

noted 2015.06.01 by E. B. Jenkins.

- §14.9, p. 160, typo: factor of 2 error. Eq. (14.43) should read

$$\frac{\langle \sigma v \rangle_{rr}}{\langle \sigma v \rangle_{ci}} \approx 2\pi \alpha^3 \frac{f_{pi}}{C} \frac{I}{kT} e^{I/kT} , \quad (14.43)$$

noted 2015.06.01 by E. B. Jenkins.

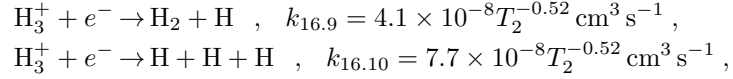
- §14.9, p. 160, typo: factor of 2 error. Eq. (14.44) and following should read

$$\frac{I}{kT} e^{I/kT} = \frac{C}{2\pi f_{pi}} \frac{1}{\alpha^3} . \quad (14.44)$$

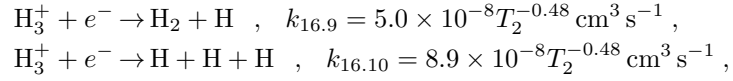
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If  $C \approx 1$  and  $f_{\text{pi}} \approx 1$ , this has solution  $I/kT \approx 10.6$ . ...  
noted 2015.06.01 by E. B. Jenkins.

- Table 15.1, p. 164, typo:  $M/M_{\odot}$  for O6.5V star: 38.0  $\rightarrow$  28.0  
noted 2013.01.31
- §16.4, p. 186, Eq. (16.9, 16.10), update: change

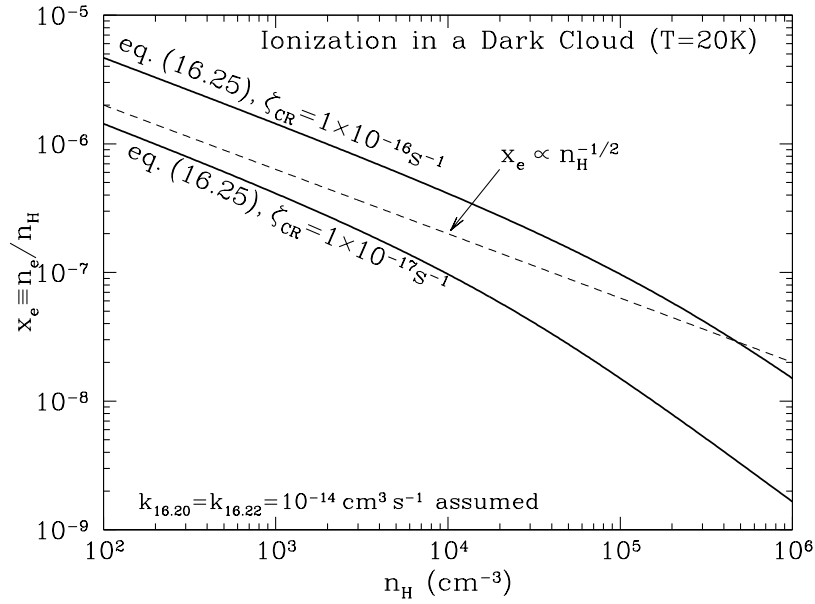


to



and cite McCall et al. (2004) for  $k_{16.9}$  and  $k_{16.10}$ .  
noted 2013.04.03

- §16.4, p. 187, typo: in paragraph below Eq. (16.15), change  
 $x_e \approx x_M \approx 1.9 \times 10^{-4} \rightarrow x_e \approx x_M \approx 1.1 \times 10^{-4}$  (see Eq. 16.3)  
noted 2013.04.04
- §16.5, p. 189, Fig. 16.3. The original figure was evaluated with a too-large rate for  $k_{16.19}$ . The figure has been redone, now also showing the result if  $\zeta_{\text{CR}} = 1 \times 10^{-17} \text{ s}^{-1}$ :



**Figure 16.3** Fractional ionization in a dark cloud, estimated using Eq. (16.25), with the grain recombination rate coefficients set to  $k_{16.20} = k_{16.22} = 10^{-14} \text{ cm}^3 \text{ s}^{-1}$  (see Fig. 14.6). The dashed line is a simple power-law approximation  $x_e \approx 2 \times 10^{-5} (n_{\text{H}} / \text{cm}^{-3})^{-1/2}$ .

noted 2013.03.05.

- §18.5, p. 214, Eq. (18.11): Change  
...  $\Omega_{03}$  is approximately independent of  $T_e$ , we have

$$\frac{n(\text{O III})}{n(\text{H}^+)} = C \frac{I([\text{O III}]5008)}{I(\text{H}\beta)} T_4^{-0.37} e^{2.917/T_4}, \quad (18.11)$$

to

...  $\Omega_{03} \propto T_4^{0.12}$  (see Appendix F), we have

$$\frac{n(\text{O III})}{n(\text{H}^+)} = C \frac{I([\text{O III}]5008)}{I(\text{H}\beta)} T_4^{-0.49} e^{2.917/T_4}, \quad (18.11)$$

noted 2015.02.27

- §19.3, p. 222: revise value for  $A_{10}$ : replace  
 $A_{10} = 6.78 \times 10^{-8} \text{ s}^{-1} \rightarrow A_{10} = 7.16 \times 10^{-8} \text{ s}^{-1}$  (see Eq. 5.7).  
noted 2013.04.17
- §19.3, p. 223: revised numbers according to revised value for  $A_{10}$ :  
Eq. (19.15): 281  $\rightarrow$  297 , Eq. (19.17): 281  $\rightarrow$  297 , Eq. (19.19): 46  $\rightarrow$  50  
noted 2013.04.17
- §23.1, p. 265, typo:  
lower oscillator strength  $f(\text{C II}]2325 \text{ \AA}) = 1.0 \times 10^{-7}$   
 $\rightarrow$   
larger oscillator strength  $f(\text{C II}]2325 \text{ \AA}) = 1.0 \times 10^{-7}$   
noted 2012.12.27
- §26.2, p. 308, Eq. (26.23), numerical error: should read

$$\frac{\omega}{2\pi} = 4.6 \text{ GHz} \left( \frac{T_{\text{rot}}}{100 \text{ K}} \right)^{1/2} \left( \frac{0.001 \mu\text{m}}{a} \right)^{5/2} \quad (26.23)$$

noted 2014.06.27 by B. Jiang.

- §28.3, p. 328, 4th paragraph, typo: change distance from  $\Theta_1 \text{ Ori C}$  to the Orion Bar ionization front:  $\sim 7.8 \times 10^{18} \text{ cm} \rightarrow \sim 7.8 \times 10^{17} \text{ cm}$   
noted 2015.04.07
- §29.1, p. 332, 1st paragraph, typo:  $b=0 \rightarrow b=90^\circ$ , so that the 2nd sentence reads  
...vary as  $N(\text{HI}, b) = N(\text{HI}, b=90^\circ) / \sin |b| = N_0 \csc |b|$ .  
noted 2012.11.04 by R. Simons.

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- §31.4, p. 349, Eq. (31.24), typo: on RHS, change

$$\frac{\pi e^2}{m_e c^2 h} \sum_u f_{\ell u} \lambda_{\ell u}^3 u_{\lambda} f_{\text{shield}, \ell u} \rightarrow \frac{\pi e^2}{m_e c^2 h} \sum_u f_{\ell u} \lambda_{\ell u}^3 u_{\lambda} f_{\text{shield}, \ell u} p_{\text{diss}, u}$$

noted 2013.04.12 by Ai-Lei Sun.

- §32.9, p. 368, just before eq. (32.11), typo: change  
 $A_V/N_H = 1.87 \times 10^{21} \text{ cm}^2 \rightarrow A_V/N_H = 5.3 \times 10^{-22} \text{ mag cm}^2$ .  
 noted 2016.03.04 by Ilsang Yoon.
- §32.11, p. 372, prepenultimate paragraph: terminological correction. Change “core” to “clump” (three occurrences).  
 noted 2015.04.16
- §34.4, p. 387, typo: Eq. (34.17) is off by a factor 3, and should read

$$t_{\text{evap}} = \frac{3M}{2\dot{M}} = \frac{25 \times 2.3 (n_H)_c R_c^2 m_e^{1/2} e^4 \ln \Lambda}{8 \times 0.87 (kT_h)^{2.5}} \quad (34.17)$$

Eq. (34.18) is numerically correct, but should have shown the dependence on  $\ln \Lambda$ :

$$= 5.1 \times 10^4 \text{ yr} \left( \frac{(n_H)_c}{30 \text{ cm}^{-3}} \right) \left( \frac{R_c}{\text{pc}} \right)^2 \left( \frac{T_h}{10^7 \text{ K}} \right)^{-2.5} \left( \frac{\ln \Lambda}{30} \right). \quad (34.18)$$

noted 2013.01.05 by B. Hensley.

- §36.2.3, p. 400, Eq. (36.10):  $v_x$  multiplying  $B_y B_x$  should be  $v_y$ , and  $v_x$  multiplying  $B_z B_x$  should be  $v_z$ .  
 noted 2015.12.17 by J. Miralda-Escudé.  
 The equation should read

$$\left\{ \left[ \frac{\rho v^2}{2} + \frac{\gamma p}{(\gamma - 1)} \right] v_x + \frac{(B_y^2 + B_z^2)}{4\pi} v_x - \frac{(B_x B_y v_y + B_x B_z v_z)}{4\pi} - \kappa \frac{dT}{dx} \right\}_1 =$$

$$\left\{ \left[ \frac{\rho v^2}{2} + \frac{\gamma p}{(\gamma - 1)} \right] v_x + \frac{(B_y^2 + B_z^2)}{4\pi} v_x - \frac{(B_x B_y v_y + B_x B_z v_z)}{4\pi} - \kappa \frac{dT}{dx} \right\}_2. \quad (36.10)$$

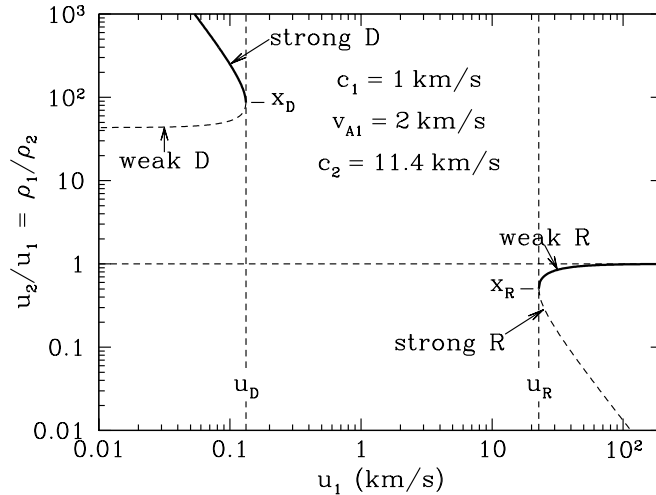
- §37.1, p. 413, 2nd paragraph: Change  
 Cases of astrophysical interest will normally have..  
 $\rightarrow$   
 Many cases of astrophysical interest will have...  
 noted 2018.04.09.
- §37.1, p. 413, typo just above Eq. (37.3):  
 $Jh\nu/c = \rho_1 u_1 h\nu/\mu_i c \ll \rho_1 (u_1^2 + c_1^2 + B_1^2/8\pi)$ .  
 $\rightarrow$   
 $Jh\nu/c = \rho_1 u_1 h\nu/\mu_i c \ll \rho_1 (u_1^2 + c_1^2) + B_1^2/8\pi$ .  
 noted 2016.12.08 by Ryohei Nakatani.

- §37.1, Eq. (37.8): The correction term for  $x_R$  is not accurate for magnetized I-fronts: change

$$x_R \approx \frac{1}{2} + \frac{2c_1^2 + v_{A1}^2}{16c_2^2} \rightarrow x_R \approx \frac{1}{2}$$

[see Kim & Kim (2014, ApJ 797:135) for better approximations.]  
 noted 2018.02.19 by Woong-Tae Kim.

- §37.1 and §37.2, pp. 414-416: the mathematics is correct, but the “weak-type”, and “strong-type” terminology was unfortunately inverted: all occurrences of “weak-type” should be changed to “strong-type”, and vice-versa:
  - §37.1.1, p. 414, first paragraph:  
 ...are called **strong R-type**. Strong R-type solutions...  
 →  
 ...are called **weak R-type**. Weak R-type solutions...
  - §37.1.1, p. 414, second paragraph:  
 ...referred to as **weak R-type**,... → ...referred to as **strong R-type**,...
  - §37.1.1, p. 414, second paragraph:  
 Hence, only strong R-type I-fronts are physically relevant.  
 →  
 Hence, only weak R-type I-fronts are physically relevant.
  - §37.1.2, p. 414, first paragraph:  
 ...is termed **weak D-type**. → ...is termed **strong D-type**.
  - §37.1.2, p. 414, second paragraph:  
 ...is termed **strong D-type**. → ...is termed **weak D-type**.
  - Fig. 37.1 and caption should be:



**Figure 37.1**  $u_2/u_1 = \rho_1/\rho_2$ , as a function of the velocity  $u_1$  of the I-front relative to the neutral gas just ahead of the I-front, for D-type and R-type ionization front solutions (see text) for an example with  $c_1 = 1 \text{ km s}^{-1}$ ,  $v_{A1} = 2 \text{ km s}^{-1}$ , and  $c_2 = 11.4 \text{ km s}^{-1}$ . The astrophysically relevant solutions are the strong D-type and weak

R-type cases, shown as heavy curves. There are no solutions with  $u_1$  between  $u_D$  and  $u_R$ .

- §37.1, p. 416, first paragraph:

...will be strong R-type, ... → ...will be weak R-type, ...

- §37.1, p. 417, fourth line:

...will now be weak D-type, ... → ...will now be strong D-type, ...

noted 2016.12.06 by Ryohei Nakatani.

- §37.2, p. 418, typos:

...moving at a speed  $v_s$  that will be close to (just slightly larger than) the speed of the I-front:

$$v_s \approx V_i . \quad (37.21)$$

→

...moving at a speed  $V_s$  that will be close to (just slightly larger than) the speed of the I-front:

$$V_s \approx V_i . \quad (37.21)$$

noted 2016.12.08 by Ryohei Nakatani.

- §38.3, p. 428, last paragraph, typo:

$$\dot{M}_w \approx 2 \times 10^{-5} \text{ km s}^{-1} \rightarrow \dot{M}_w \approx 2 \times 10^{-5} M_\odot \text{ yr}^{-1}$$

noted 2015.12.17 by J. Miralda-Escudé.

- §39.1.2, p. 433, Eqs. (39.22, 39.23, 39.24), typos: the factor  $(E_{51}/n_0^2)$  should be  $(E_{51}n_0^2)$ , so that the equations should read

$$v_s(t_{\text{rad}}) = 188 \text{ km s}^{-1} (E_{51}n_0^2)^{0.07} , \quad (39.22)$$

$$T_s(t_{\text{rad}}) = 4.86 \times 10^5 \text{ K} (E_{51}n_0^2)^{0.13} , \quad (39.23)$$

$$kT_s(t_{\text{rad}}) = 41 \text{ eV} (E_{51}n_0^2)^{0.13} . \quad (39.24)$$

noted 2012.10.02 by G.B. Field.

- §39.4, p. 438, Eqs. (39.35) and (39.36), typos: they should read

$$N_{\text{SN}} = 0.24 S_{-13} E_{51}^{1.26} n_0^{-1.47} c_{s,6}^{-13/5} \quad (39.35)$$

$$= 0.48 S_{-13} E_{51}^{1.26} n_0^{-0.17} p_4^{-1.30} , \quad p_4 \equiv \frac{p/k}{10^4 \text{ cm}^{-3} \text{ K}} \quad (39.36)$$

noted 2014.06.27 by B. Jiang.

- §39.4, p. 438, Eq. (39.37), typos: Eq. (39.37) should read

$$\frac{p}{k} = S_{-13}^{0.77} E_{51}^{0.97} n_0^{-0.13} \times 5700 \text{ cm}^{-3} \text{ K} \quad (39.37)$$

noted 2014.06.27 by B. Jiang.



- §40.5, p. 447, typo: protons with  $E \lesssim 10^5$  GeV have  $R_{\text{gyro}} < 10^{-4}$  pc  $\rightarrow$  protons with  $E \lesssim 10^3$  GeV have  $R_{\text{gyro}} < 10^{-4}$  pc  
noted 2011.04.26

- §41.3, p. 456, typo: missing factor of  $G$ . Eq. (41.36) should read

$$E_{\text{grav}} = -\frac{G}{2} \int dV_1 \int dV_2 \frac{\rho(\mathbf{r}_1)\rho(\mathbf{r}_2)}{|\mathbf{r}_1 - \mathbf{r}_2|} \quad (41.36)$$

noted 2015.04.30 by J. Greco.

- §41.3.2, p. 457, Eq. (41.46), typo: replace

$$E_{\text{mag}} = \frac{B_{\text{rms}}^2 - B_0^2}{8\pi} V \quad \rightarrow \quad E_{\text{mag}} = \frac{B_{\text{rms}}^2}{8\pi} V$$

noted 2011.04.28

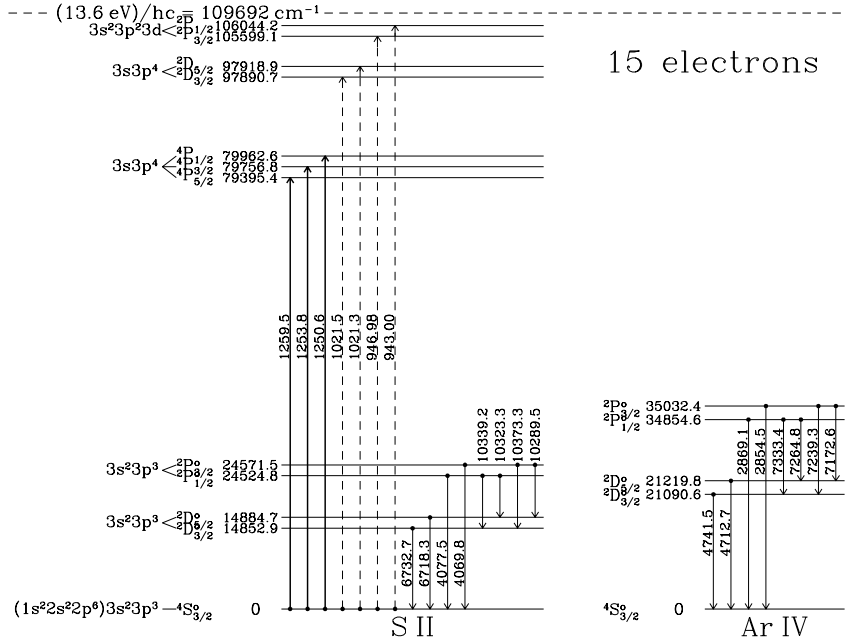
- §41.4, p. 460, Eq. (41.55), typo:  $m_m \rightarrow m_n$   
noted 2013.04.30 by K. Silsbee

- Appendix A, p. 473, typo: entry for  $a_0$  should read  
...Bohr radius  $\equiv \hbar^2/m_e e^2 = \dots$   
noted 2013.03.05 by Wenhua Ju.

- Appendix D, p. 481: corrected typos:  
F VI  $\rightarrow$  VII:  $I = 147.163 \rightarrow 157.163$   
Ne VI  $\rightarrow$  VII:  $I = 154.214 \rightarrow 157.934$   
Ti III  $\rightarrow$  IV:  $I = 24.492 \rightarrow 27.492$   
Ti V  $\rightarrow$  VI:  $I = 123.7 \rightarrow 99.299$   
Zn VI  $\rightarrow$  VII:  $I = 133.903 \rightarrow 108.0$   
noted 2015.07.10 by Guangtun Ben Zhu.

- Appendix E, p. 495:  ${}^2D_{3/2,5/2}^o$  energy levels were misplotted for S II and Ar IV.  
noted 2013.10.21 by Bon-Chul Koo.  
Corrected figure [Opportunity taken to update energy Ar IV energy levels

using latest values from NIST Atomic Spectra Database (ver. 5.1 [Online]):



- Appendix F, Table F.2, p. 497, typo: the first transition listed for S III: change  $^3P_0 - ^1P_0 \rightarrow ^3P_0 - ^3P_1$  noted 2016.10.03 by C.D. Kreisch.

- Appendix F, Table F.3, p. 498: updated electron collision strengths for O I:

Ion	$\ell - u$	$\Omega_{u\ell}$	Note
O I	$^3P_2 - ^3P_1$	$0.0105 T_4^{0.4861+0.0054 \ln T_4}$	<i>a</i>
"	$^3P_2 - ^3P_0$	$0.00459 T_4^{0.4507-0.0066 \ln T_4}$	<i>a</i>
"	$^3P_1 - ^3P_0$	$0.00015 T_4^{0.4709-0.1396 \ln T_4}$	<i>a</i>
"	$^3P_J - ^1D_2$	$0.0312(2J+1) T_4^{0.945-0.001 \ln T_4}$	<i>b</i>
"	$^3P_J - ^1S_0$	$0.00353(2J+1) T_4^{1.000-0.135 \ln T_4}$	<i>b</i>
"	$^1D_2 - ^1S_0$	$0.0893 T_4^{0.662-0.089 \ln T_4}$	<i>b</i>

...

*a* fit to Bell et al. (1998)  
*b* fit to Zatsarriny & Tayal (2003)  
 noted 2015.02.27

- Appendix F, Table F.6, p. 501: The table title should be “Rate Coefficients for ... Deexcitation...” rather than “... Excitation...”. noted 2015.07.03
- Appendix F, Table F.6, p. 501: the rates for entries 5 and 6 should be interchanged, so that entries 4-6 read

H	CI	${}^3P_0 - {}^3P_1$	$1.26 \times 10^{-10} T_2^{0.115+0.057 \ln T_2}$	<i>b</i>
H	CI	${}^3P_0 - {}^3P_2$	$8.90 \times 10^{-11} T_2^{0.228+0.046 \ln T_2}$	<i>b</i>
H	CI	${}^3P_1 - {}^3P_2$	$2.64 \times 10^{-10} T_2^{0.231+0.046 \ln T_2}$	<i>b</i>

noted 2015.07.03 by Munan Gong.

- Appendix F, Table F.6, p. 501: the rates for entries 23-28 should be changed to

H <sub>2</sub> (para)	OI	${}^3P_2 - {}^3P_1$	$1.49 \times 10^{-10} T_2^{0.369-0.026 \ln T_2}$	<i>h</i>
H <sub>2</sub> (ortho)	OI	${}^3P_2 - {}^3P_1$	$1.37 \times 10^{-10} T_2^{0.395-0.005 \ln T_2}$	<i>h</i>
H <sub>2</sub> (para)	OI	${}^3P_2 - {}^3P_0$	$2.37 \times 10^{-10} T_2^{0.255+0.016 \ln T_2}$	<i>h</i>
H <sub>2</sub> (ortho)	OI	${}^3P_2 - {}^3P_0$	$2.23 \times 10^{-10} T_2^{0.284+0.035 \ln T_2}$	<i>h</i>
H <sub>2</sub> (para)	OI	${}^3P_1 - {}^3P_0$	$2.10 \times 10^{-12} T_2^{1.117+0.070 \ln T_2}$	<i>h</i>
H <sub>2</sub> (ortho)	OI	${}^3P_1 - {}^3P_0$	$3.00 \times 10^{-12} T_2^{0.792+0.188 \ln T_2}$	<i>h</i>

noted 2015.08.24 by E.B. Jenkins.

- Appendix I, p. 506, typo: ...a time  $\sim E_{ul}/h \rightarrow$  ...a time  $\sim h/E_{ul}$   
noted 2013.02.07 by Munan Gong.
- Appendix J, p. 510, Eq. (J.13), typo:

$$\Pi_0 \equiv \oint d\mathbf{S} \cdot \mathbf{r}p \quad \rightarrow \quad \Pi_0 \equiv \frac{1}{3} \oint d\mathbf{S} \cdot \mathbf{r}p$$

noted 2017.03.08.