# Physics of the Interstellar and Intergalactic Medium

## Errata in the second and third printings.

Updated 2017.03.08

Bruce T. Draine

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# Errata in the second and third printings.

- §1.2, p. 8, Table 1.4: change abundance of P from $N_{\rm P}/N_{\rm H} = 3.23 \times 10^{-7\pm0.03}$, $M_{\rm P}/M_{\rm H} = 1.00\times10^{-5}$ to $N_{\rm P}/N_{\rm H} = 2.82\times10^{-7\pm0.03}$, $M_{\rm P}/M_{\rm H} = 8.73 \times 10^{-6}$
  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

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

  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-$H_2O$ must have $K_{-1}+K_{+1}$ odd $\rightarrow$
  para-$H_2O$ must have $K_{-1}+K_{+1}$ even
  and
  ortho-$H_2O$ must have $K_{-1}+K_{+1}$ even $\rightarrow$
  ortho-$H_2O$ must have $K_{-1}+K_{+1}$ odd
  noted 2015.01.15 by Neal Evans.

- §8.3, p. 74, Eq. (8.26), typos: $T_A^{\rm on}(v) \rightarrow T_A^{\rm off}(v)$ (two occurrences).
  noted 2013.02.14 by Munan Gong.

- §9.10, Table 9.4, p. 88, typos: for C II and N III, change ${}^2{\rm D}_J^o \rightarrow {}^2{\rm D}_J$ for $J = 3/2$ and $J = 5/2$.
  noted 2015.02.12 by Semyeong Oh.

- §11.4, p. 110, Eq. (11.35) should read

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

  noted 2013.02.03 by W. Vlemmings.

- §12, p. 121, Table 12.1, typos:

| | | | | |
|---|---|---|---|---|
| CMB, $T = 2.725\,\mathrm{K}$ | : | $4.19\times10^{-13}$ | $\rightarrow$ | $4.17\times10^{-13}$ |
| $T_2 = 4000\,\mathrm{K}$, $W_2 = 1.65\times10^{-13}$ | : | $3.19\times10^{-13}$ | $\rightarrow$ | $3.20\times10^{-13}$ |
| $T_3 = 7500\,\mathrm{K}$, $W_3 = 1\times10^{-14}$ | : | $2.29\times10^{-13}$ | $\rightarrow$ | $2.39\times10^{-13}$ |
| Starlight total | : | $1.05\times10^{-12}$ | $\rightarrow$ | $1.06\times10^{-12}$ |
| ISRF total | : | $2.19\times10^{-12}$ | $\rightarrow$ | $1.98\times10^{-12}$. |

  noted 2012.11.08

- §12.5, p. 123, below eq. (12.4): change
  ...$W_1$ by 40%, from $W_1 = 5\times10^{-13}$ to $7\times10^{-13}$. $\rightarrow$
  ...$W_1$ by 75%, from $W_1 = 4\times10^{-13}$ to $7\times10^{-13}$, and raised $W_2$ from $1.0\times10^{-13}$ to $1.65\times10^{-13}$.
  noted 2014.11.11 by S. Bianchi.

- §13.1, p. 130, second paragraph, typo:
  ...to $3\times10^{-10}\,\mathrm{s}^{-1}$ for Si $\rightarrow$ ...to $3\times10^{-9}\,\mathrm{s}^{-1}$ for Si
  noted 2017.03.05

- §14.6, p. 154, Table 14.8 update: replace

| | | |
|---|---|---|
| $\mathrm{H}_3^+ + e^- \rightarrow \mathrm{H}_2 + \mathrm{H}$ | $1.1\times10^{-7}T_2^{-0.56}$ | McCall et al. (2004) |

  with

| | | |
|---|---|---|
| $\mathrm{H}_3^+ + e^- \rightarrow \mathrm{H} + \mathrm{H} + \mathrm{H}$ | $8.9\times10^{-8}T_2^{-0.48}$ | McCall et al. (2004) |
| $\mathrm{H}_3^+ + e^- \rightarrow \mathrm{H}_2 + \mathrm{H}$ | $5.0\times10^{-8}T_2^{-0.48}$ | McCall et al. (2004) |

  noted 2013.04.03

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

$$\sigma_{\rm rr}(E) = \frac{g_\ell}{2g_u}\frac{(I+E)^2}{Em_ec^2}\sigma_{\rm pi}(h\nu = I+E) \quad . \tag{14.41}$$

  noted 2015.06.01 by E. B. Jenkins.

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

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

  noted 2015.06.01 by E. B. Jenkins.

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

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

  If $C \approx 1$ and $f_{\rm pi} \approx 1$, 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

$$H_3^+ + e^- \rightarrow H_2 + H \quad , \quad k_{16.9} = 4.1\times10^{-8}T_2^{-0.52}\,\mathrm{cm^3\,s^{-1}} \,,$$
$$H_3^+ + e^- \rightarrow H + H + H \quad , \quad k_{16.10} = 7.7\times10^{-8}T_2^{-0.52}\,\mathrm{cm^3\,s^{-1}} \,,$$

to

$$H_3^+ + e^- \rightarrow H_2 + H \quad , \quad k_{16.9} = 5.0\times10^{-8}T_2^{-0.48}\,\mathrm{cm^3\,s^{-1}} \,,$$
$$H_3^+ + e^- \rightarrow H + H + H \quad , \quad k_{16.10} = 8.9\times10^{-8}T_2^{-0.48}\,\mathrm{cm^3\,s^{-1}} \,,$$

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
$x_e \approx x_M \approx 1.9\times10^{-4} \quad \rightarrow \quad x_e \approx x_M \approx 1.1\times10^{-4}$ (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 $\zeta_{\rm CR} = 1\times10^{-17}\,\mathrm{s}^{-1}$:

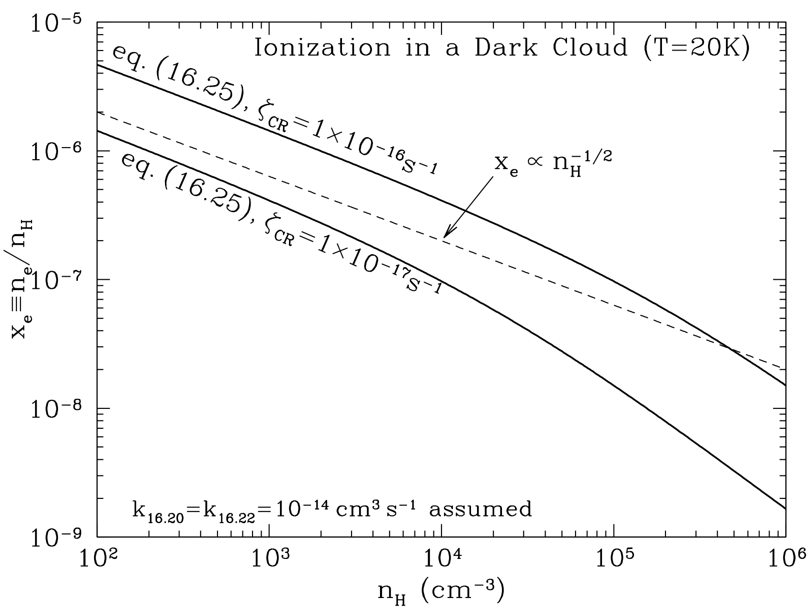



**Figure 16.3** Fractional ionization in a dark cloud, estimated using Eq. (16.25), with the grain recombination rate coefficients set to $k_{16.20} = k_{16.22} = 10^{-14}\,\mathrm{cm^3\,s^{-1}}$ (see Fig. 14.6). The dashed line is a simple power-law approximation $x_e \approx 2\times10^{-5}(n_{\rm H}/\,\mathrm{cm^{-3}})^{-1/2}$.

noted 2013.03.05.

- §18.5, p. 214, Eq. (18.11): Change
  ... $\Omega_{03}$ is approximately independent of $T_e$, we have
  $$\frac{n(\mathrm{O\,III})}{n(\mathrm{H}^+)} = C\frac{I([\mathrm{O\,III}]5008)}{I(\mathrm{H}\beta)}T_4^{-0.37}\mathrm{e}^{2.917/T_4} , \qquad (18.11)$$
  to
  ... $\Omega_{03} \propto T_4^{0.12}$ (see Appendix F), we have
  $$\frac{n(\mathrm{O\,III})}{n(\mathrm{H}^+)} = C\frac{I([\mathrm{O\,III}]5008)}{I(\mathrm{H}\beta)}T_4^{-0.49}\mathrm{e}^{2.917/T_4} , \qquad (18.11)$$
  noted 2015.02.27
- §19.3, p. 222: revise value for $A_{10}$: replace
  $A_{10} = 6.78 \times 10^{-8}\,\mathrm{s}^{-1} \rightarrow A_{10} = 7.16 \times 10^{-8}\,\mathrm{s}^{-1}$ (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 $f(\mathrm{C\,II}]2325\,\text{Å}) = 1.0 \times 10^{-7}$
  $\rightarrow$
  larger oscillator strength $f(\mathrm{C\,II}]2325\,\text{Å}) = 1.0 \times 10^{-7}$
  noted 2012.12.27
- §26.2, p. 308, Eq. (26.23), numerical error: should read
  $$\frac{\omega}{2\pi} = 4.6\,\mathrm{GHz}\left(\frac{T_{\mathrm{rot}}}{100\,\mathrm{K}}\right)^{1/2}\left(\frac{0.001\,\mu\mathrm{m}}{a}\right)^{5/2} \qquad (26.23)$$
  noted 2014.06.27 by B. Jiang.
- §28.3, p. 328, 4th paragraph, typo: change distance from $\Theta_1$Ori C to the Orion Bar ionization front: $\sim 7.8\times10^{18}\,\mathrm{cm} \rightarrow \sim 7.8\times10^{17}\,\mathrm{cm}$
  noted 2015.04.07
- §29.1, p. 332, 1st paragraph, typo: $b=0 \rightarrow b=90°$, so that the 2nd sentence reads
  ...vary as $N(\mathrm{H\,I}, b) = N(\mathrm{H\,I}, b = 90°)/\sin|b| = N_0 \csc|b|$.
  noted 2012.11.04 by R. Simons.
- §31.4, p. 349, Eq. (31.24), typo: on RHS, change
  $$\frac{\pi e^2}{m_e c^2 h}\sum_u f_{\ell u}\lambda_{\ell u}^3 u_\lambda f_{\mathrm{shield},\ell u} \rightarrow \frac{\pi e^2}{m_e c^2 h}\sum_u f_{\ell u}\lambda_{\ell u}^3 u_\lambda f_{\mathrm{shield},\ell u}\, p_{\mathrm{diss},u}$$
  noted 2013.04.12 by Ai-Lei Sun.

- §32.9, p. 368, just before eq. (32.11), typo: change
  $A_V/N_{\rm H} = 1.87\times10^{21}\,{\rm cm}^2 \quad\rightarrow\quad A_V/N_{\rm H} = 5.3\times10^{-22}{\rm mag\,cm}^2$.
  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

$$t_{\rm evap} = \frac{3M}{2\dot{M}} = \frac{25\times2.3(n_{\rm H})_c R_c^2 m_e^{1/2} e^4 \ln\Lambda}{8\times0.87(kT_h)^{2.5}} \qquad (34.17)$$

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

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

  noted 2013.01.05 by B. Hensley.

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

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

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

- §37.1, p. 413, typo just above Eq. (37.3):
  $Jh\nu/c = \rho_1u_1h\nu/\mu_ic \ll \rho_1(u_1^2+c_1^2+B_1^2/8\pi)$.
  $\rightarrow$
  $Jh\nu/c = \rho_1u_1h\nu/\mu_ic \ll \rho_1(u_1^2+c_1^2)+B_1^2/8\pi$.
  noted 2016.12.08 by Ryohei Nakatani.

- §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...
    $\rightarrow$
    ...are called **weak R-type**. Weak R-type solutions...
  - §37.1.1, p. 414, second paragraph:
    ...referred to as **weak R-type**,... $\rightarrow$ ...referred to as **strong R-type**,...

- §37.1.1, p. 414, second paragraph:
  Hence, only strong R-type I-fronts are physically relevant.
  $\rightarrow$
  Hence, only weak R-type I-fronts are physically relevant.
- §37.1.2, p. 414, first paragraph:
  ...is termed **weak D-type**. $\rightarrow$ ...is termed **strong D-type**.
- §37.1.2, p. 414, second paragraph:
  ...is termed **strong D-type**. $\rightarrow$ ...is termed **weak D-type**.
- Fig. 37.1 and caption should be:

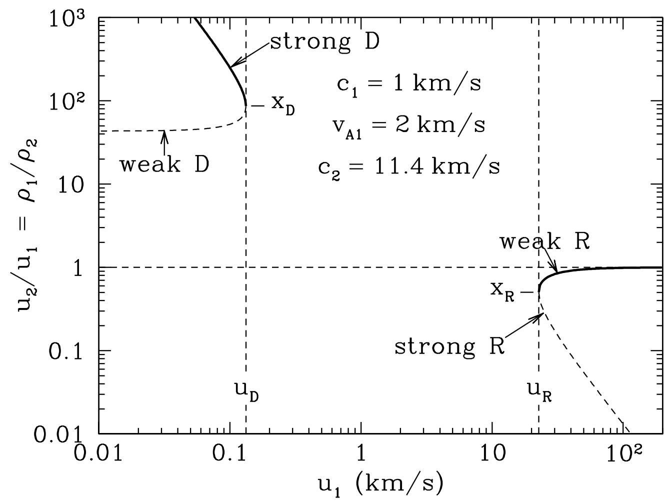



**Figure 37.1** $u_2/u_1 = \rho_1/\rho_2$, as a function of the velocity $u_1$ of the I-front relative to the neutral gas just ahead of the I-front, for D-type and R-type ionization front solutions (see text) for an example with $c_1 = 1\,\mathrm{km\,s^{-1}}$, $v_{A1} = 2\,\mathrm{km\,s^{-1}}$, and $c_2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

- §37.1, p. 416, first paragraph:
  ...will be strong R-type, ... $\rightarrow$ ...will be weak R-type, ...
- §37.1, p. 417, fourth line:
  ...will now be weak D-type, ... $\rightarrow$ ...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:
  $$v_s \approx V_i \quad . \tag{37.21}$$
  $\rightarrow$
  ...moving at a speed $V_s$ that will be close to (just slightly larger than) the speed of the I-front:
  $$V_s \approx V_i \quad . \tag{37.21}$$

noted 2016.12.08 by Ryohei Nakatani.

- §38.3, p. 428, last paragraph, typo:
  $\dot{M}_w \approx 2\times10^{-5}\,\mathrm{km\,s^{-1}} \rightarrow \dot{M}_w \approx 2\times10^{-5}\,M_\odot\,\mathrm{yr}^{-1}$
  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

$$v_s(t_{\rm rad}) = 188\,\mathrm{km\,s^{-1}}(E_{51}n_0^2)^{0.07} \quad , \qquad (39.22)$$
$$T_s(t_{\rm rad}) = 4.86\times10^5\,\mathrm{K}(E_{51}n_0^2)^{0.13} \quad , \qquad (39.23)$$
$$kT_s(t_{\rm rad}) = 41\,\mathrm{eV}(E_{51}n_0^2)^{0.13} \quad . \qquad (39.24)$$

noted 2012.10.02 by G.B. Field.

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

$$N_{\rm SN} = 0.24 S_{-13} E_{51}^{1.26} n_0^{-1.47} c_{s,6}^{-13/5} \qquad (39.35)$$
$$= 0.48 S_{-13} E_{51}^{1.26} n_0^{-0.17} p_4^{-1.30} \quad , \quad p_4 \equiv \frac{p/k}{10^4\,\mathrm{cm^{-3}\,K}} \qquad (39.36)$$

noted 2014.06.27 by B. Jiang.

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

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

noted 2014.06.27 by B. Jiang.

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

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

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

noted 2015.04.30 by J. Greco.

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

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

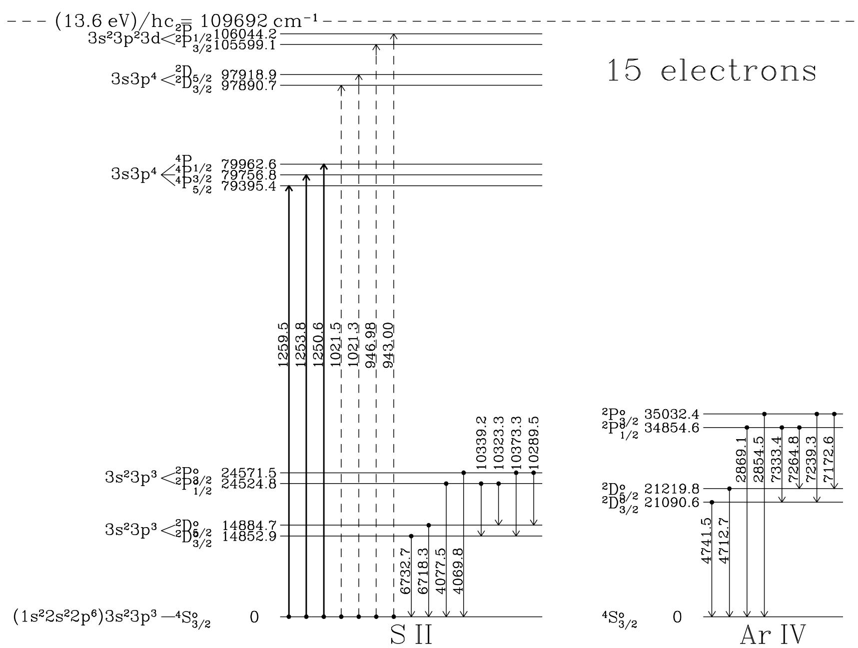
noted 2011.04.28

- §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 $\equiv \hbar^2/m_e e^2 =$...
  noted 2013.03.05 by Wenhua Ju.

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

- Appendix E, p. 495: ${}^2\mathrm{D}^o_{3/2,5/2}$ 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 ${}^3\mathrm{P}_0$–${}^1\mathrm{P}_0 \rightarrow {}^3\mathrm{P}_0$–${}^3\mathrm{P}_1$
  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 | $^3$P$_2$–$^3$P$_1$ | $0.0105\,T_4^{0.4861+0.0054\ln T_4}$ | *a* |
| ” | $^3$P$_2$–$^3$P$_0$ | $0.00459\,T_4^{0.4507-0.0066\ln T_4}$ | *a* |
| ” | $^3$P$_1$–$^3$P$_0$ | $0.00015\,T_4^{0.4709-0.1396\ln T_4}$ | *a* |
| ” | $^3$P$_J$–$^1$D$_2$ | $0.0312(2J{+}1)\,T_4^{0.945-0.001\ln T_4}$ | *b* |
| ” | $^3$P$_J$–$^1$S$_0$ | $0.00353(2J{+}1)\,T_4^{1.000-0.135\ln T_4}$ | *b* |
| ” | $^1$D$_2$–$^1$S$_0$ | $0.0893\,T_4^{0.662-0.089\ln T_4}$ | *b* |
| | | ... | |

*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 | C I | $^3$P$_0$ – $^3$P$_1$ | $1.26\times10^{-10}T_2^{0.115+0.057\ln T_2}$ | *b* |
| H | C I | $^3$P$_0$ – $^3$P$_2$ | $8.90\times10^{-11}T_2^{0.228+0.046\ln T_2}$ | *b* |
| H | C I | $^3$P$_1$ – $^3$P$_2$ | $2.64\times10^{-10}T_2^{0.231+0.046\ln T_2}$ | *b* |

noted 2015.07.03 by Munan Gong.

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

| | | | | |
|---|---|---|---|---|
| $H_2$(para) | O I | $^3$P$_2$ – $^3$P$_1$ | $1.49\times10^{-10}T_2^{0.369-0.026\ln T_2}$ | *h* |
| $H_2$(ortho) | O I | $^3$P$_2$ – $^3$P$_1$ | $1.37\times10^{-10}T_2^{0.395-0.005\ln T_2}$ | *h* |
| $H_2$(para) | O I | $^3$P$_2$ – $^3$P$_0$ | $2.37\times10^{-10}T_2^{0.255+0.016\ln T_2}$ | *h* |
| $H_2$(ortho) | O I | $^3$P$_2$ – $^3$P$_0$ | $2.23\times10^{-10}T_2^{0.284+0.035\ln T_2}$ | *h* |
| $H_2$(para) | O I | $^3$P$_1$ – $^3$P$_0$ | $2.10\times10^{-12}T_2^{1.117+0.070\ln T_2}$ | *h* |
| $H_2$(ortho) | O I | $^3$P$_1$ – $^3$P$_0$ | $3.00\times10^{-12}T_2^{0.792+0.188\ln T_2}$ | *h* |

noted 2015.08.24 by E.B. Jenkins.

- Appendix I, p. 506, typo: ...a time $\sim E_{u\ell}/h \rightarrow$ ...a time $\sim h/E_{u\ell}$
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.