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Erratum: 'Improved He I emissivities in the Case B approximation'

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Erratum: 'Improved He I emissivities in the Case B approximation'

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This is an erratum to the paper entitled 'Improved He I emissivities in the Case B approximation' published in MNRAS 425, L28 (2012). A setup error caused allowed resonance lines to escape via scattering from free electrons. Transitions to the ground state should not escape in the Case-B approximation. The escaping line photons resulted in decreased populations of $n\mathrm{p}\,^1\mathrm{P}$ levels, and indirectly decreased populations of other levels (via radiative decays and collisions). This most strongly affected low-L singlet transitions at densities $\lesssim 10^5\,\mathrm{cm}^{-3}$.

We have turned off the process and recalculated our results. Corrections to lines emitted from $n\mathrm{p}\,^1\mathrm{P}$ levels can be more than an order of magnitude, while lines from $n\mathrm{s}\,^1\mathrm{S}$ levels are corrected by up to a factor of ∼2. This affected 11 of the 44 lines reported in the supplemental table. Most lines are affected by ∼1 per cent or less. All line emissivities increase (or are negligibly affected) due to this change.

An additional error was the inadvertent disabling of some collisions with $\Delta n > 5$. This slowed approach to local thermodynamic equilibrium with increasing temperature or density, but the effects are generally comparable to or less than the uncertainties due to collisional rates. This omission has also been corrected here. Line emissivities can both increase and decrease as a result of this change. The behaviour is a function of temperature and density.

Fig. 1 pertained only to fundamental data and not the results of simulations. It is unaffected by the error. Figs 2 and 4 are only weakly affected. The identified trends are unchanged, and reproducing those figures is unnecessary.

Of the six emissivity ratios in Fig. 3, which are re-plotted here, four of them are only weakly affected. The results for λλ5876 and 6678 have increased as a result of the changes described here, the latter because its upper level, $3\mathrm{d}\,^1\mathrm{D}$, is strongly populated by radiative decays from higher $n\mathrm{p}\,^1\mathrm{P}$ levels, the former because $3\mathrm{d}\,^1\mathrm{D}$ and $3\mathrm{d}\,^3\mathrm{D}$ are strongly mixed collisionally. These changes are in the same direction but smaller than the ones reported in the original paper.

We also compared our new emissivities to the full set of Benjamin, Skillman & Smits (1999; hereafter BSS99) results at 10 000 K and $n_\mathrm{e} = 100\,\mathrm{cm}^{-3}$. The largest difference (∼6 per cent) is for λ17003 and seems to be directly attributable to different absorption oscillator strengths published by Kono & Hattori (1984) and Drake (1996). Only 12 of the remaining 32 emissivities differ by more than 1 per cent – the largest by ∼3 per cent. The differences are strongly correlated with differences in recombination coefficients. Much larger differences continue to exist at higher densities and temperatures.

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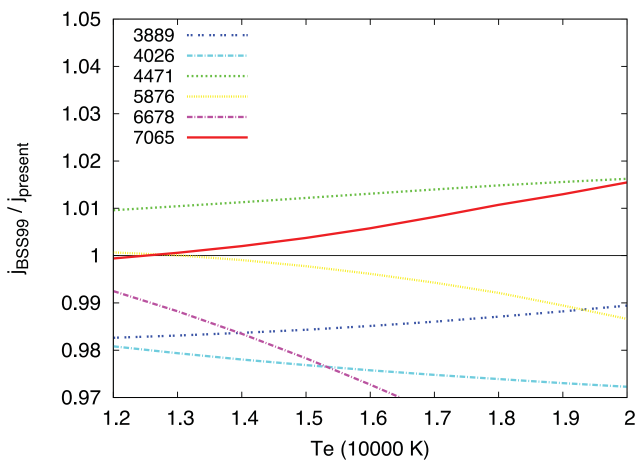

Figure 3. Ratio of BSS99 and present emissivities for several strong lines as a function of temperature with $n_\mathrm{e} = 100\,\mathrm{cm}^{-3}$.

Table 1 contained a line list and associated level designations and does not require corrections. Table 2 and the supplemental table have been updated.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Emissivities of He I lines for $5000 \le T_e \le 10000\ K$ and $10^1 \le n_e \le 10^{14}\ \mathrm{cm}^{-3}$. Details contained within supplemental data file (http://mnrasl.oxfordjournals.org/lookup/suppl/doi:10.1093/mnrasl/slt049/-/DC1).

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Table 2. Emissivities of several He I lines at conditions important for primordial abundance analyses. This table is a small subset of the full results. Values are $4\pi j/n_e n_{He+}$ in units of 10^{-25} erg cm^3 s^{-1}.

T_e (K)	n_e (cm^{-3})	3889 Å	4026 Å	4471 Å	5876 Å	6678 Å	7065 Å
10 000	10	1.3897	0.2905	0.6105	1.6838	0.4788	0.2876
11 000	10	1.2987	0.2655	0.5556	1.5162	0.4306	0.2729
12 000	10	1.2201	0.2442	0.5092	1.3767	0.3904	0.2601
13 000	10	1.1513	0.2259	0.4695	1.2589	0.3566	0.2488
14 000	10	1.0906	0.2100	0.4352	1.1582	0.3277	0.2389
15 000	10	1.0365	0.1960	0.4052	1.0712	0.3028	0.2299
16 000	10	0.9880	0.1837	0.3788	0.9954	0.2810	0.2219
17 000	10	0.9442	0.1727	0.3554	0.9287	0.2620	0.2146
18 000	10	0.9044	0.1629	0.3345	0.8697	0.2451	0.2079
19 000	10	0.8680	0.1540	0.3157	0.8172	0.2301	0.2017
20 000	10	0.8347	0.1460	0.2988	0.7701	0.2166	0.1961
10 000	100	1.4005	0.2910	0.6116	1.6872	0.4796	0.2978
11 000	100	1.3115	0.2661	0.5571	1.5240	0.4326	0.2850
12 000	100	1.2349	0.2449	0.5113	1.3889	0.3938	0.2741
13 000	100	1.1681	0.2268	0.4722	1.2755	0.3614	0.2644
14 000	100	1.1092	0.2111	0.4385	1.1792	0.3338	0.2559
15 000	100	1.0568	0.1973	0.4091	1.0964	0.3102	0.2482
16 000	100	1.0098	0.1851	0.3833	1.0245	0.2898	0.2411
17 000	100	0.9673	0.1743	0.3604	0.9616	0.2720	0.2347
18 000	100	0.9286	0.1647	0.3401	0.9061	0.2563	0.2287
19 000	100	0.8933	0.1560	0.3218	0.8571	0.2424	0.2233
20 000	100	0.8609	0.1481	0.3054	0.8133	0.2300	0.2183
10 000	1000	1.4732	0.2939	0.6206	1.7530	0.4969	0.3759
11 000	1000	1.4004	0.2700	0.5698	1.6164	0.4576	0.3775
12 000	1000	1.3393	0.2501	0.5279	1.5090	0.4269	0.3793
13 000	1000	1.2868	0.2333	0.4930	1.4233	0.4027	0.3808
14 000	1000	1.2408	0.2189	0.4635	1.3540	0.3835	0.3815
15 000	1000	1.1998	0.2064	0.4382	1.2970	0.3680	0.3814
16 000	1000	1.1627	0.1955	0.4164	1.2493	0.3554	0.3804
17 000	1000	1.1285	0.1859	0.3973	1.2086	0.3448	0.3785
18 000	1000	1.0969	0.1775	0.3805	1.1740	0.3359	0.3762
19 000	1000	1.0678	0.1700	0.3659	1.1457	0.3284	0.3745
20 000	1000	1.0405	0.1632	0.3528	1.1206	0.3217	0.3721

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