DIELECTRONIC RECOMBINATION IN THE GASEOUS NEBULAE AS A COOLING PROCESS

A.F. KHOLTYGIN
S.-Petersbourg Univ. Astron. Obs., 198904, St.Petergof, Russia

The dielectronic recombination (DR) is of importance at 'low' (nebular) temperature [1]. This process leads to cooling the electron gas in nebulae. The cooling rate by recombination of ion X^{+n} is

$$L_{dr}(T_e) = \sum_j \frac{4\,\pi^{3/2}\,a_0^3}{(k\,T_e/Ry)^{3/2}}\,\frac{g_j\,W_j^a}{g^+}\,exp\left(-\frac{\Delta\,E_j}{k\,T_e}\right)\frac{W_j^r}{W_j^a+W_j^r}\,\Delta\,E_j.$$

Here W_j^r and W_j^a are respectively the radiation and autoionization probabilities for the autoionization state j of ion X^{+n} , ΔE_j is the energy of this state, g_j and g^+ are respectively the statistical weights of the state j and the ground state of the ion X^{+n+1} . We have calculated $L_{dr}(T_e)$ for all ions of C. It is shown that the process of DR cooling is important only for nebulae with extraordinarily high abundances ($\{C^{+i}/H^+\} > 0.01$) of these ions.

References

[1]. Nussbaumer H., Storey P.J. (1984) 'Dielectronic recombination at low temperature.II: Recombination coefficients for lines at C, N, O' , Astronomy and Astrophysics, 56, 293-312.

https://doi.org/10.1017/S0074180900170548 Published online by Cambridge University Press