Abstract for ICAMDATA05, Meudon, France
October 15–19, 2006

Effect of directional energetic electrons on the density diagnostic of hot plasmas

M.K. Inal[1] and J. Dubau[2]

[1] *Université A. Belkaid, Département de Physique, Tlemcen, Algeria*
[2] *LIXAM, Université Paris-Sud, Orsay, France*

m_inal@mail.univ-tlemcen.dz

Domain : Astrophysics, Fusion

The intensity ratio $R = z/(x+y)$ of the He-like forbidden line z ($1s2s\,^3S_1 \rightarrow 1s^2\,^1S_0$) and intercombination lines x and y ($1s2p\,^3P_{2,1} \rightarrow 1s^2\,^1S_0$) is often used as a diagnostic of the electron density in a variety of astrophysical and laboratory plasmas. Most of the reported studies on this diagnostic tool have dealt with an isotropic Maxwellian distribution for the plasma electrons. In this work, we investigate how the presence of a small proportion of directional energetic electrons in hot plasmas affects the R ratio and so can modify the density diagnostic as compared to a pure Maxwellian plasma.

We have calculated the R ratio of Ne^{8+} as a function of the total electron density in the $10^9 - 10^{13}$ cm^{-3} range, taking into account the polarization and anisotropy of the line emission. The calculations have been carried out considering various values of the temperature T_e ($2 - 5 \times 10^6$ K) of the Maxwellian component as well as the energy E ($1 - 5$ keV) and fraction f ($1 - 5\%$) of the directional electron component. The rate coefficients for excitation from the $1s^2\,^1S_0\,M_J = 0$ ground and $1s2s\,^3S_1\,M_J = 0, \pm 1$ metastable magnetic sublevels, due to both thermal and beam electrons, were obtained from data reported in [1] and [2], respectively. We find that the electron density deduced from the R ratio under the assumption of a pure Maxwellian distribution can be very significantly overestimated or underestimated depending on the angle observation with respect to the direction of the electron beam present in the emitting plasma.

[1] D. Porquet and J. Dubau, Astron. Astrophys. Suppl. Ser. **143**, 495 (2000).
[2] S.W. Rachedi, M.K. Inal and J. Dubau, J. Phys. B **38**, 547 (2005).