Coronal approach for determining temperature of rarefied magnetized helium plasma

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We propose spectral method for determining electron temperature of electric discharge helium plasma in plasma linear multicusp (PLM) [1] with heavy particle density [He]$\approx 10^{12}$–10^{14} cm^{-3} and electron density $n_e \approx 10^{11}$–10^{13} cm^{-3} utilizing coronal approach. The relation between ion and atom spectral line intensities is most sensitive to electron temperature in this conditions. We have found that a comparison of the experimental intensities relation of ion He II spectral line 468.56 nm and a number of He I atomic lines with well-known electron excitation constants to the calculated values of this relation as a function of the average electron energy is a reliable method of spectroscopic determination of electron temperature of nonequilibrium low pressure magnetized helium plasma. For these experiment conditions: [He] $\approx 10^{14}$ cm^{-3}, discharge current 210 A, voltage drop 160–180 V, plasma column radius 16 mm and length 370 mm the value of electron temperature found from two singlet and two triplet He I lines was $T_e = 2.4 \pm 0.2$ eV.

[1] Budaev V P, Fedorovich S D, Martynenko Y V, Lukashevsky M Vand Gubkin M K, Karpov A V, Lazukin A V, Shestakov E A, Kavyrshin D I and Rogozin K S 2019 *Phys. Atom. Nuclei* **82** 1281–1291