Observation of Non-Maxwellian Electron Energy Distribution in a High-Power-Diode Plasma

M. Sarfaty, M.E. Foord, A. Fruchtman, L. Troyansky and Y. Maron

Nuclear Physics Department
Weizmann Institute of Science
Rehovot, Israel

Time-dependent measurements of the level populations ratios and the electron density, together with time-dependent collisional radiative calculations, are used to determine the electron temperature in an intense ion-diode plasma. Level population ratios in CIII triplets, MgII, and AlIII, in which the measured levels lie within $\simeq$ 10 eV, indicate an electron temperature of 5-8 eV. However, ratios from CIII singlets and BIII atomic systems in which the measured levels lie within $\simeq$25 eV, indicate a much higher temperature: 20-30 eV from BIII and 30-50 eV from CIII singlet, these results suggest the existence of a higher-energy component for the electrons.

Spatially resolved line intensity ratios of CIII triplets and singlets together with BIII indicate that the electron temperature across the plasma is uniform, having the same line intensity ratios as in the spatially integrated measurements.

Detailed calculations are being used to study four different possible electron energy distributions: two unshifted Maxwellians, one shifted and one unshifted Maxwellian, relativistic electron component, and a runaway electron distribution. Electron distributions which best fit the measured line ratios are given and possible explanations are discussed.