

Balmer- α Spectrum Measurement of the LHD One-Third Ion Source

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Doppler shift of Balmer- α line spectrum emission from hydrogen atoms in extraction region of a negative hydrogen (H^-) ion source can give information on how hydrogen plasma in the region interact with the plasma grid surface of the ion source. A spectrometer of 1 m focal length (Acton Research Corporation Model AM-510) with a CCD detector capable of resolving 2 pm records optical emission spectra around Balmer- α line from the plasma in the extraction region of the LHD one-third ion source. The observed line spectra exhibit broadening due to fine structure, together with additional broadening arising from some change in discharge operation parameters like pressure and arc power. An optical fiber coupled to a collimator lens collects photons along the line of sight intersecting the plasma grid surface with an angle smaller than 7.5 degree. The measured spectra have shown a blue shift with the broadening, when the plasma grid was biased more negatively than the voltage corresponding to the plasma potential of the extraction region. The blue shift component increased as the plasma grid was biased more negatively. Fundamental processes determining the final velocity distribution of hydrogen atoms are investigated including evaluation of the contribution from surface collision at the plasma grid surface based on ACAT (Atomic Collisions in Amorphous Target) code calculation.