§29. Study of Neutral Hydrogen and Impurity Behavior in Heliotron J Plasmas

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The Doppler-shifted Hα emissions from the injected neutral beams are useful to measure the fracion of three energy components of the neutral beams from positive ions, beam profiles and attenuation lengths in the plasmas. In Heliotron J the Doppler-shifted Hα emissions are measured to estimate beam attenuation profiles in neutral beam heated plasmas. Figure 1 shows sightlines and neutral beam. The optical system consists of a SPEX1269 visible spectrometer with a CCD camera and fiber optics with 30 sightlines. The angles between the injected beam line and sightlines are 35 ~ 82 degrees.

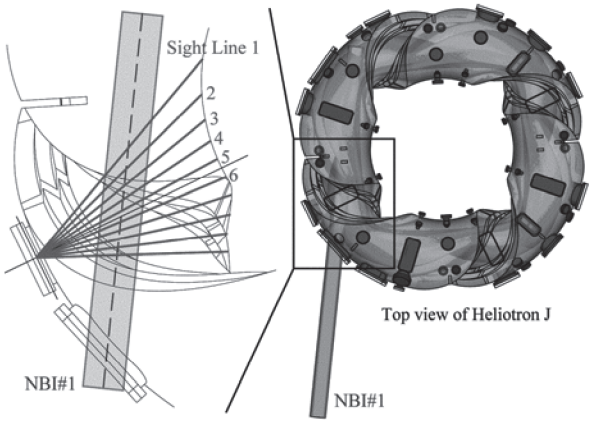

Figure 1

Figure 2 shows Hα emissions observed at various sightlines. The top of the figure 2 shows the Doppler-shifted Hα emissions from the neutral beam with energy of E, E/2 and E/3. The acceleration voltage E is 23 keV and beam power is 0.5 MW. The peak left to the E/3 component is C II. From the intensity ratio of these three components the fraction of the beam density of E, E/2 and E/3 are 63%, 25% and 12%, respectively

The intensity of the Hα emissions is expressed as $I(E/k;k=1,2,3) = GR(\lambda)n_b(E/k)n_e < \sigma v_b >$ where G is geometric factor, $R(\lambda)$ sensitivity, $n_b(E/k)$ beam density, n_e electron density and $< \sigma v_b >$ excitation rate. After the construction of the electron density profiles in the observation cross section, the attenuation profiles or decay of the beam are determined. The width of the observed Hα emission spectra is broader than that expected from the beam energy divergence.

The spectral shape will be analyzed by considering Zeeman and Stark effects.

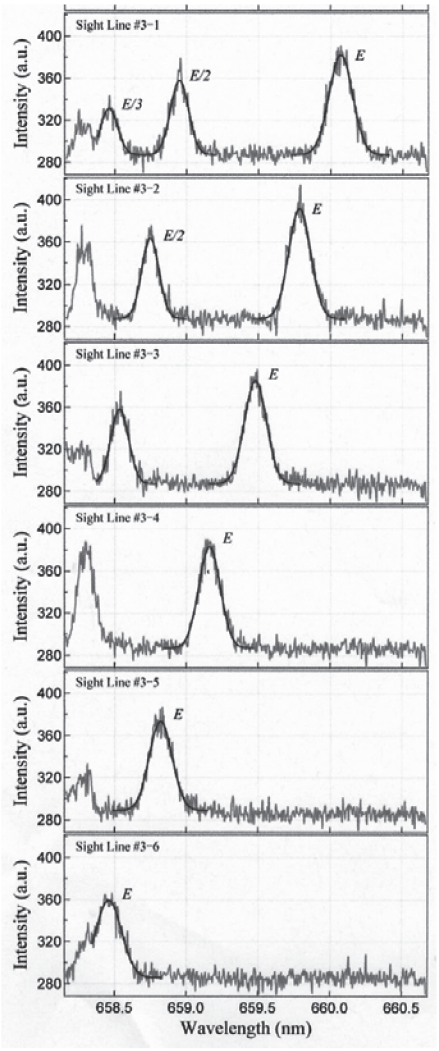

Figure 2