

#### §4. Study of Impurity Ion Radiation Intensity in the GAMMA 10 Plasma

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Time- and space-resolved spectroscopic measurements of impurity ion radiation spectra give us a lot of important information, such as time and space variations of plasma density, electron and ion temperatures, etc. After comparing the collisional-radiative model (CR-model)<sup>1)</sup> calculation results for impurity ion line radiation intensities and those measured by spectroscopic method, we can obtain the impurity ion densities, electron density and temperatures. The aim of this study is to construct the database for plasma spectroscopic diagnostics in the fusion plasmas.

We studied the profiles of impurity radiation and density, and ionization and transport processes in a mirror system. We developed the new CR-model code for lower charge state of oxygen ions which is suitable to study of impurity behavior in the range of plasma parameter of GAMMA 10. We used flexible atomic

code (FAC) developed by M. F. Gu.<sup>2)</sup> We calculated the electron impact excitation and ionization cross sections with FAC. We had evaluated the results of FAC calculation to the database at NIST in order to use the results of FAC for CR-models. Then we have constructed the CR-model for Oxygen ions of  $O^+$  to  $O^{4+}$ . In Fig. 1, we show the spectroscopic measured Oxygen ions radiation radial profiles and radial density profiles calculated by using our CR-model codes.

Moreover, we have constructed multi-channel UV/V spectrometer system using two spectrometers to obtain an entire wavelength range of UV/visible impurity spectra (200-700 nm) with a high wavelength resolution in single plasma shot. We evaluated radiation loss with ECRH from the GAMMA 10 plasma in the UV/visible range; further we estimate the electron density and temperature after applying the measured spectral intensity data to a CR-model.

#### Reference

- 1) Kato, T., et al.: Fusion Eng. Des., **34-35** (1997) 789.
- 2) M. F. Gu: ApJ., 582 (2003) 1241.

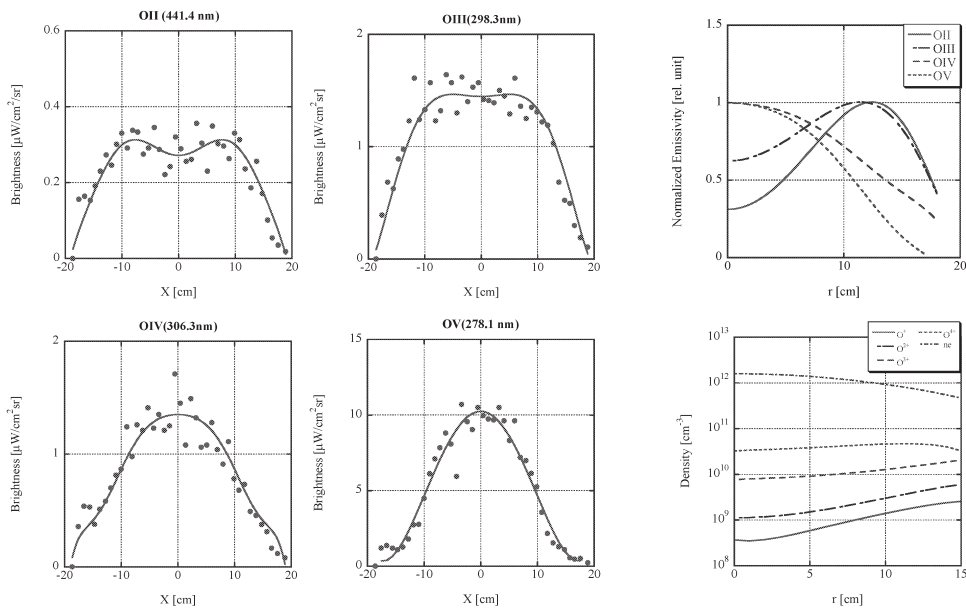


Fig. 1: Spectroscopic measured results of Oxygen ions and Oxygen ions density radial profiles calculated by using CR-model.