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SMBI実験におけるGAMMA10セントラル部の分光計測
Radiation Spectra Measurements on SMBI Experiments in the GAMMA10 Central Cell

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Abel transform is useful technique to obtain the emissivity profile of plasma from the radial distribution of the line integral emission. GAMMA10 plasma is normally axisymmetric. We usually use the Abel transform technique in the assumption of axisymmetric emissivity profile of the plasma. However, the emissivity profile is not always axisymmetric. If the Abel transform is applied to non-axisymmetric plasma, the estimation error becomes large. In order to reduce the estimation error, we try to improve the analysis method for spectroscopic measurements by constructing the non-axisymmetric Abel transform technique.

GAMMA 10 is a 27 m long tandem mirror plasma confinement device with a thermal barrier. The plasma is created by using plasma guns and is heated and sustained by using ion cyclotron range of frequency heating system. In typical hot ion mode plasmas produced in the core region of the central cell, electron density, electron temperature and ion temperature are about 2×10^{12} cm^{-3}, 100 eV and 5 keV, respectively

In GAMMA10, supersonic molecular beam injection (SMBI) experiments (Fig. 1) are carried out under the collaboration with HELIOTRON group of Kyoto University. SMBI was installed in GAMMA10 for fueling study. In order to survey the effects of SMBI on the plasma behavior, we measure the plasma radiation by using the ultraviolet and visible (UV/V) spectroscopic system. SMBI is installed to supply fueling gas into the core of plasma. SMBI injects hydrogen gas into plasma from the bottom of GAMMA10.

The ultraviolet and visible (UV/V) spectroscopic system (Fig. 2) has 40-optical-fibers whose diameters are 400 μm. The plasma emissions collected by the two quartz lens is transported to the spectrometer (JASCO CT100) through the optical fibers. The observed wavelength range is 200-670 nm.

In SMBI experiment, the plasma has a strong asymmetric profile. The plasma parameters are changed rapidly when SMBI injects a lot of hydrogen molecular gas.

In this presentation, we show the established Abel transform method which assumed non-axisymmetric plasma profile and the calculation results of the ion emissivities from the line integral emissions radial distributions by using this method. Moreover, we show the calculated impurity ion density and the hydrogen neutral density in order to study the effects of SMBI in GAMMA10 plasma.

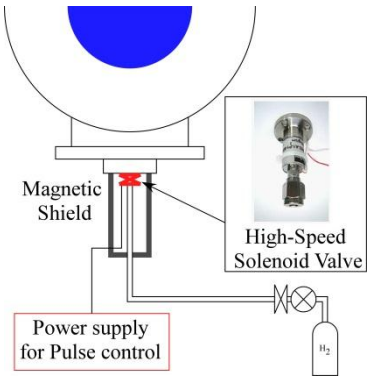

Fig. 1: SMBI system.

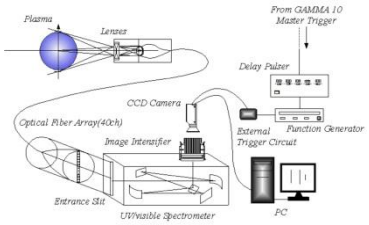

Fig. 2: The UV/V spectroscopic system.