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直線プラズマ装置PANTAにおける分光計測とアーベル変換による画像再構成

Reconstruction of radial profiles of light emission intensity in PANTA

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Understanding of plasma turbulence is an essential issue to realize and control fusion plasmas since turbulence-driven transport affects significantly plasma confinement. Turbulence state consists of various spatio-temporal scale fluctuations, therefore, the plasma turbulence needs to be observed multi-dimensionally with covering a wide range of spatial scales. In a cylindrical plasma device PANTA in Kyushu University[1], a spectroscopic system surrounding the plasma for tomography is being constructed to measure two-dimensional structure of turbulence with a fine resolution, and as its first trial, the reconstruction of local emission profile in steady states is being made from one dimensional measurement in argon plasmas of PANTA.

PANTA produces a linear cylindrical plasma with the diameter of ~0.1 m and axial length of 4 m by helicon wave (7 MHz, 3 KW). The line-integrated measurements were carried out for four different ranges of wavelength by optical filters; blue (480 nm), red (700 nm), infrared (900 nm), and UV (300 nm) light. The system for each wavelength range consists of 33 channels aligned in the vertical direction. In this experiment, the magnetic field was fixed at 0.9 kG with argon gas pressure of 1 mTorr. The measurement was performed with selecting 16 channels that covered the plasma region from the center to an edge on one side.

Assuming azimuthal symmetry of the cylindrical plasmas, radial profile of local emission is reconstructed by different procedures, *i.e.,* using the Abel inversion after fitting functions to the measured profile of line integrated profile, and solving a linear matrix equation to connect the local emission to the line integrated profile. Figure 1 shows an example of the measured line-integrated profile and the local emission profiles inferred from the method of solving the matrix equation and applied Abel inversion with spline interpolation in the case of the blue light (ArII emission) for an argon plasma, suggesting a sharply peaked profile around the plasma center of r<~2cm. The evaluation of these reconstructed radial profile will be discussed.

The poster presents the initial results obtained with the developing system for tomography and details of the reconstruction methods, with the progress and future in the construction of a two-dimensional observation system in PANTA.

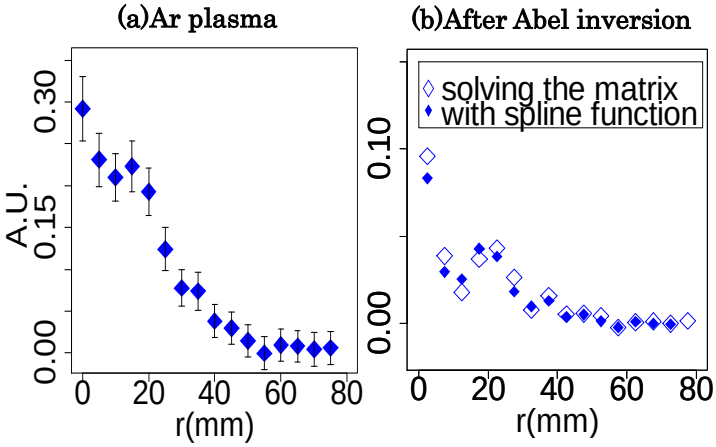

Fig. 1 (a) Measured profile of light intensity with blue in an argon plasma, and (b) an inverted radial profile of the light emission.

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References

[1] H Arakawa et al Plasma Phys. Control. Fusion 53 115009(2011)