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高速度カメラによる高密度ヘリコンプラズマ光の2次元分布計測
Two-Dimensional Measurements of High-Density Helicon Plasma Light using High-Speed Camera

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1. Introduction

Most electric thrusters have a problem of short lifetime because of their electrode damages caused by a direct contact between electrodes and plasmas. To solve this problem, we have proposed a completely electrodeless plasma thruster [1]. Here, it is also necessary to measure plasma parameters without direct contact with the plasma, and an optical measurement is one of candidates.

2. Measurement Method

The measurement which we have proposed is to obtain local distributions of electron density n_e, its temperature T_e, and neutral density n_0 in a cross-sectional view by observing plasma emission lights. They are observed by a high-speed camera via three fiberscopes with spectral filters and a coupling optics. Here, it is necessary to reconstruct a local emission distribution from line-integrated intensities, applying two methods in the next section, leading to a determination of n_e and T_e using e.g., a Collisional Radiative (CR) model [2].

3. Reconstruction Method

In order to estimate a local distribution of intensity accurately, choosing a proper reconstruction method is important. We have been developing two reconstruction methods for three fan-views: Algebraic Reconstruction Technique (ART) [3] and Fourier-Bessel expansions method (F-B method) [4]. Here, ART is a successive approximation reconstruction method, and F-B method is a two-dimensional fitting method using Fourier-Bessel expansions. Simulation results of test data using ART and F-B method will be presented in the conference.

4. Experiment Devices and Plasma Measurement

We measured the plasma emission intensities of Large Mirror Device (LMD) [5], as shown in Fig. 1. In this study, n_e and n_0 of the plasma were estimated in two-dimensions, by measuring Ar I and Ar II lines. The electron density profiles by optical measurement are consistent compared with those of probe data, as shown in Fig. 2. The two-dimensional maps of them will be presented in the conference.

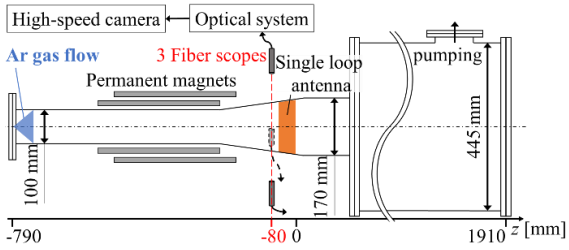

Fig. 1. Schematic of LMD and measurement system.

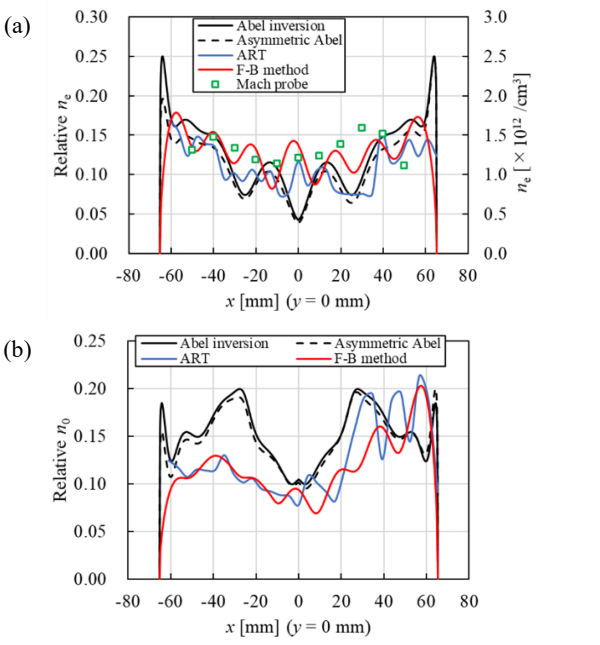

Fig. 2. Radial profiles of (a) n_e and (b) n_0. Here, profiles by Abel inversion is normalized.

References

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