Abstract Submitted
for the GEC18 Meeting of
The American Physical Society

Spectroscopic Measurement of Plasma Parameters in a Helium ECR Discharge Produced under a Simple Cusp Field AKIRA UEDA, TAIICHI SHIKAMA, TATSUYA TERAMOTO, TAKANORI HIGASHI, Department of Mechanical Engineering and Science, Graduate School of Engineering, Kyoto University, YOHEI IIDA, Bunkoukeiki Co.,Ltd., MASAHIRO HASUO, Department of Mechanical Engineering and Science, Graduate School of Engineering, Kyoto University — An electron cyclotron resonance (ECR) discharge in a simple cusp field can produce a large volume steady-state plasma with relatively high electron density and degree of ionization (DOI). We have developed a spectroscopic method for evaluating the spatial distributions of the plasma parameters in a helium discharge. In this method, we measured the local intensity ratios between specific pairs of helium atom (He I) emission lines and compared the measured ratios with the calculated ones using a collisional-radiative (CR) model [1]. We determined the two-dimensional (axial and radial) distributions of the electron temperature and density, ground and metastable state helium atom densities, and the magnitude of photoexcitation in a plasma produced using 2.45 GHz and 800 W microwaves at 67 mPa. We found that electron density and DOI reach more than $2\times10^{17}\mathrm{m}^{-3}$ and 20 %, respectively, inside the closed ECR surface and investigated the validity of the evaluated atomic densities and the magnitude of photoexcitation by comparing with the theoretical predictions [2]. [1] A. Ueda, et al., Phys. Plasmas 25, 054508 (2018). [2] A. Ueda, et al., Appl. Phys. Lett 111, 074101 (2017).

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Date submitted: 14 Jun 2018 Electronic form version 1.4