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Title

Measurements of xenon ions velocity in Cylindrical Hall Thruster with Laser-Induced Fluorescence spectroscopy

Authors

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Abstract

Hall effect thrusters (HET) are a mature propulsion technology that has been used on-board large satellites for decades, particularly for station keeping. While HET operating above 1 kW of power have been tested extensively, new challenges arise with low-power devices and a better understanding of the physics at play in the discharge is necessary. Designing a cylindrical channel, instead of the usual annular one, can mitigate some of the issues related to down-scaling. The absence of central pole allows for simplified manufacturing, thermal management, and prevents ceramic erosion in the region of the exit plane. However, the topology of the magnetic field is consequently altered and the dynamics of the internal discharge in a Cylindrical Hall Thruster (CHT) are different from the ones of a traditional HET.

This work presents measurements of the velocity distribution function (VDF) of metastable xenon ions inside and in the near-field of a 200 W CHT. Velocity measurements are performed by means of Laser-Induced Fluorescence (LIF) spectroscopy [1]. Different locations in the plume and in the thruster channel are probed to identify the acceleration region and interactions between the ions and the ceramic walls in the vicinity of the exit plane [2]. The effect of the intense magnetic field in the CHT is observed on the fluorescence signal and a model is used to retrieve the ion velocity [3]. Several thruster operating conditions are compared to analyze the effect on the ions.

References

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