

P4.3003 On confinement and plasma acceleration from a small ECR plasma source

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.3003.pdf>

The use of the Electron Cyclotron Resonance (ECR) for electron heating for Magnetic Nozzle (MN) thrusters have recently received increased interest, as they have been shown (Cannat et al, Phys. Plasmas, 22, 053503 (2015)) to provide improved thrust efficiency up to 16% at only 30 W input power. Such performance make such thrusters viable for use on small, e.g. Cubesat, spacecraft. An ECR plasma source similar to that described by Jarrige et al., 35th Int. Electrical Prop. Conf., Atlanta, USA, Oct. 8-12, 2017, IEPC-2017-382, was recently installed in a 30 cm diameter and 60 cm long cylindrical chamber at UiT. This source is grounded, as opposed to the previously described one, which is shielded from ground. The source consists of a cylindrical sleeve antenna of diameter 2.6 cm, and was operated at 10 - 20 W, at mass flow rates from 0.2 - 0.8 mg/s, which result in pressures ranging from 0.08 - 0.3 Pa. High-resolution radial profiles of plasma parameters were obtained by means of Langmuir, ion energy analyzer and Mach probes, at two different axial positions 20 cm and 50 cm from the source, i.e. in the far plume of the source. The configurations were i) a monotonous expanding magnetic field, ii) a bottle-shaped magnetic field, and iii) a nearly homogeneous magnetic field with straight lines. Here, we will focus on results with the monotonous expanding magnetic field. Results in terms radial profiles of density n_e , electron temperature T_e , plasma potential V_p , and ion energy with respect to the background plasma potential is reported and compared to available models and previous experimental results. While the plasma stream from the source has come to a complete halt at 50 cm from the source, the speed of the ions at 20 cm equals the ion sound speed of about 4.4 km/s.

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