Physics of low pressure magnetized plasmas for space propulsion

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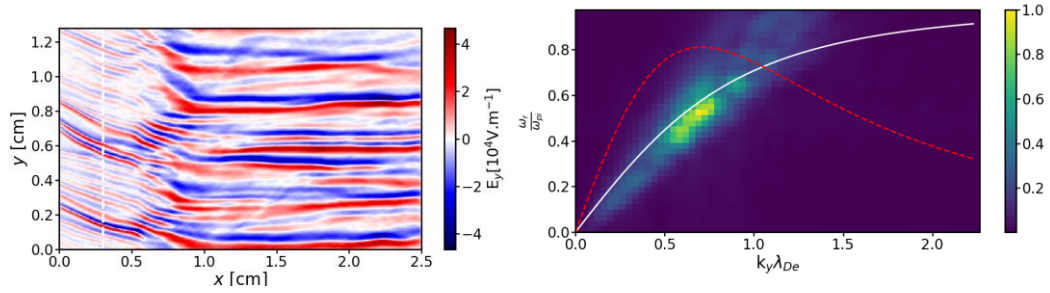
Electric (plasma) propulsion is a key technology in the space industry and for the deep space exploration programs [1]. Research in this field has always been active and basic plasma physics is needed to understand the complexity of the plasma engines. The research involves gas discharge physics, such as ionization instabilities and secondary electron emission from the walls, and basic magnetized plasma physics including drifts in ExB fields and related instabilities and anomalous transport.



The talk will give an overview of the recent research carried out on Hall thrusters [2]. There has been tremendous progress in the modelling of Hall thrusters and in particular on a better description of instabilities responsible for anomalous transport in the thruster channel and in the near plume (see figures above showing an instability in the MHz range with millimetric wavelength). This progress relies both on 2D (even 3D) particle-in-cell simulations and on kinetic theory [3,4]. It will also be shown that synthetic diagnostics, i.e. "experimental" signals produced by numerical simulations, is a powerful tool for simulation validation. Classical experimental signals such has coherent Thompson scattering can be synthetically generated from PIC simulations allowing a detailed and precise comparison between synthetic and real signals [5]. The same applies for optical emission spectroscopy.

References

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