Experimental Study Of Magnetized Electron Transport In Low Temperature Plasmas In Closed And Bounded Drift Configurations

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Magnetized low temperature plasmas are widely used in different types of applications: material processing, space propulsion, or neutral beam injection. However, the effect of the magnetic field on low temperature plasma is far from being fully understood. In cross-field devices such as sputtering magnetrons and Hall effect ion sources, the magnetic field is radial and the electric field is axially directed so that the magnetic drift is closed along the azimuthal direction and does not participate to the electron transport to the walls; the transport losses across the magnetic field (B) scales as $1/B^2$. However, many experiments have shown "anomalous" increased transport scaling as 1/B indicating that the drift comes into play for example through plasma instabilities/turbulence generating electric fields and pressure gradients along the azimuthal direction in spite of the cylindrical symmetry. In magnetic configurations similar as the neutral beam injection configuration, the drift is bounded by the walls and tends to induce plasma asymmetry in order to redirect the drift towards the electrodes leading to an increased electron transport across the magnetic barrier. The aim of this work is to provide experimental measurements to compare with a home-built 2.5 dimensional fluid model in order to improve the understanding of the electron transport mechanism in both closed and bounded drift configurations. For this study, a specific experimental set-up and two different tunable magnetic field configurations have been designed and developed. The electron transport is characterized by measuring the local ion and electron current densities by using a segmented wall planar probe.[1] We will present, compare and discuss the experimental results emphasizing the effect of the external magnetic field intensity on the electron current density profiles and/or its temporal evolution in both configurations.

Acknowledgements: This work is supported by French National Research Agency (project METRIS ANR-11-JS09-008).

[1] R. Baude, F. Gaboriau, and G.J.M. Hagelaar, *Rev. Sci. Instrum.* **84**, 083502 (2013).