Flow Measurement in a Helicon Plasma Source

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Motivation/Objectives

- Determine the best way to use helicon source for population.
- From previous experiments, the ion temperature anisotropy in LEIA exhibits strong dependence on HELIX parallel flow. Does parallel flow create plasma anisotropies that heat ions and reduce parallel flow?
- Are certain helicon source operating regimes more suitable for creating parallel flow than others?
- Can shear in the parallel flow be created and controlled for studies of parallel flow shear driven instabilities (see R. Spangler poster on Tuesday afternoon for theory details)

Experimental Apparatus

Flow Measurement in a Helicon Plasma Source

Pressure = 2.9 mTorr
Pressure = 9.7 mTorr

HELIX 2D LIF System (perpendicular injection)

LIF Measurement of Parallel Flow

Absolute and normalized (to \( v_{th} \)) parallel flow decreases with RF power!

Absolute and normalized (to \( v_{th} \)) parallel flow increases with HELIX magnetic field strength

Absolute and normalized (to \( v_{th} \)) parallel flow increases with LEIA magnetic field strength

Summary

- Iodine cell is used for determining the dye laser wavelength, the accuracy is about 0.001 Å.
- The parallel velocity is proportional to magnetic field in HELIX and LEIA chamber, and has an inverse correlation with RF power and the neutral gas pressure.
- Under certain conditions, the parallel flow depends on rf frequency as well as magnetic field strength. Does this occur with the full ten coil configuration?
- Future work: investigate relationship between flow in HELIX and in LEIA as a function of field geometry and other parameters.