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Ion Velocimetry In Magnetized DC Sheaths[1] CHRISTOPHER YOUNG, ANDREA LUCCA FABRIS, MARK CAPPELLI, Stanford University Plasma Physics Laboratory — Particle dynamics near the magnetic cusps in cusped field plasma thrusters are still not well understood; characterizing the ion velocity distribution functions in these regions can help thruster designs maximize electron trapping and minimize erosion of the channel wall. To that end, a robust argon ion velocity sensor is developed using a three-level laser-induced fluorescence (LIF) technique. The $3d^4F_{7/2} \rightarrow 4p^4D^0_{5/2}$ ArII transition at 668.61 nm is pumped with a 25 mW tunable external cavity diode laser, and fluorescence down to the $4s^4P_{3/2}$ state at 442.72 nm is collected with phase-sensitive detection. The Doppler shift in the acquired signal peak, compared to a stationary reference, gives the ion velocity component parallel to the exciting laser. We demonstrate this LIF scheme by obtaining the argon ion velocity profile through a magnetized DC sheath. The LIF measurement is used to validate a new optogalvanic velocimetry technique in which two lasers (chopped at different frequencies) intersect one another at 90° in the measurement volume. Using a lock-in amplifier, changes observed in the DC discharge current at the sum and difference of the two chopping frequencies may be related back to the mean ion velocity at that point.

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