Absorption Spectroscopy Measurements of Ion Velocity Distribution Functions in Argon Plasmas

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Motivation/Objectives
The scarcity of strong absorption lines in accessible tuning ranges along with plasma saturation due to low ion population densities makes absorption spectroscopy of helium ions extremely difficult. Helicon plasmas, with their characteristic high ion densities, are a good candidate for initial helium ion absorption spectroscopy experiments. However, preliminary measurements of Doppler broadened ion velocity distribution functions (IVDFs) using a tunable diode laser, tuned to 1012.61 nm and chopped roughly at 1kHz, along the axis of a 1.5m long helicon plasma have yielded erratic and irreproducible measurements. Here we present absorption spectroscopy measurements of ivdfs in argon helicon plasma using a tunable diode laser at 1012.61 nm tuned to Ar II resonance 442.72 nm. The reference molecular iodine fluorescence spectrum (blue) obtained simultaneously. The diode laser was tuned to the same experimental configuration will then be used for the infrared helium ion absorption measurement. The measurement technique is optimized for the well-known and more easily diagnosed Ar II transition, but will be described and initial measurements in pulsed argon plasmas presented. Once the absorption measurements are taken, the technique will then be used for the infrared helium ion absorption measurements...