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2.9 Laser Induced Fluorescence for Singly Ionized Atomic Iodine

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While xenon is the standard propellant for a wide range of plasma thrusters, xenon is expensive and xenon propellant systems require heavy compressed gas tanks, pressure regulators, and other bulky hardware. Iodine has similar mass and is much easier to acquire than xenon. Iodine's natural state of matter at room temperature is solid and is easily sublimated to gas with a simple heating element. This advantage for iodine is also a significant challenge when developing gas handling systems for iodine. Another challenge for iodine thrusters is a lack of well-defined spectroscopic diagnostics for single ionized iodine, specifically, a lack of a demonstrated laser induced fluorescence (LIF) scheme. We present emission spectroscopy measurements of iodine ion emission from the 6pˆ5P_3-5dˆ5 D_4ˆo transition at 695.868 nm and the 6pˆ5P_3-6sˆ5S_2ˆo transition at 516.12 nm as a function of microwave power for a microwave excited iodine plasma in a sealed quartz cell at a pressure of 1 mTorr. The 5dˆ5D_4ˆo state is metastable and was identified by Hargus et al. [48th AIAA Joint Propulsion, 2012] as a strong candidate for an iodine ion LIF scheme. We will also present preliminary LIF measurements using this three-level scheme with a tunable dye laser operating at 695.878 nm.

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