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Two Photon Absorption Laser Induced Fluorescence of Helium Ions in a Microwave Assisted Helicon Source[1] EARL SCIME, West Virginia University — The spectroscopic measurement of helium ion velocity distribution functions in a low temperature plasma is problematic for a number of reasons. First and foremost is the difficulty in accessing the UV and soft x-ray transitions to the ground state. Conventional laser induced fluorescence on ions in plasmas is routinely performed in argon, neon, xenon, and barium. Two-photon absorption laser induced fluorescence (TALIF) on neutrals has been demonstrated in hydrogen, nitrogen, and oxygen plasmas. We have successfully performed LIF on helium atoms and have had some hints of success with laser absorption spectroscopy on excited states of helium ions, the n = 5 to n = 6 transition in the infrared (1012 nm). Here we report a new approach using TALIF to access the n = 2 to n = 6 transition of singly ionized helium. The fluorescence path at 656 nm completes the three-level sequence. To obtain the electron temperatures necessary to create a sufficient population of metastable helium ions trapped in the 2S state, we have increased the electron temperature of a helicon plasma with 1.2 kW of microwaves at 2.45 GHz. Here we report emission spectroscopy measurements that confirm the increase in excited state population densities and preliminary TALIF measurements on helium ions.

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