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Novel Plasma Diagnostic Method Using Spectroscopy for Hall Thruster Optimization[1] ARIEL SANDBERG, REBECCA MARTIN, JULIA NISTEL, BROOKE BROZEK, TIMOTHY SMITH, Univ of Michigan - Ann Arbor
— We present preliminary tests in a parallel-plate argon discharge plasma of an optical diagnostic that provides non-invasive, time-resolved qualitative measurements of relative neutral and ionic species densities. The technique uses retroreflected intrinsic line emission as a source for absorption [2], with a ratio of reflected-and-absorbed emission strength to direct emission strength that decreases monotonically with absorbing species density. Time histories of this ratio clearly show low-frequency (100 mHz) oscillations driven in a $pd = 1.5$ cm-Torr argon discharge (at a plasma density of $2.5 \times 10^{13}/\text{cm}^3$ and electron temperature of 3.66 eV). Future experiments will add a parallel retroflected line emission beam, interference-filtered photomultipliers, and high-speed beam chopping to provide a two-point plasma wave dispersion diagnostic for hollow cathode ion acoustic turbulence [3]

[1]Supported by the UM Plasmadynamics and Electric Propulsion Laboratory
[2]M.A. Cappelli et al., "Vacuum ultraviolet absorption measurements of ground state xenon in the near field of a low power Hall thruster," AIAA-2003-5007, AIAA Joint Propulsion Conference, Huntsville, AL, 20-23 Jul 2003.
[3]M.P. Georgin et al., "Passive high-speed imaging of ion acoustic turbulence in a hollow cathode," AIAA-2017-4973, Jul 2017.

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