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Direct Measurement of the Phase Space Ion Fluctuation Spectrum of a Laboratory Plasma Using Two Independently Tunable Lasers[1]
SEAN MATTINGLY, JORGE BERUMEN, FENG CHU, RYAN HOOD, FRED SKIFF, Department of Physics and Astronomy, University of Iowa — A novel technique for probing velocity space correlations has been developed using laser-induced fluorescence. The experiment consists of a 3m cylindrical plasma column of singly-charged Argon ions (Ar II) with density $\sim 109cm^{-3}$, $T_e \sim 5eV$, $T_i \sim .06eV$, and a 1kG axial magnetic field. Separate metastable lines of the Ar II ions are excited using two separate narrow bandwidth lasers. The LIF response from each laser is measured through an independently moveable periscope. These periscopes may be focused on the same localized region ($\sim 0.1cm^3$) or separated to view different parts of the plasma simultaneously. By adjusting these lasers independently, one may measure a correlation function as a function of the difference in measured velocities. This measurement may be repeated for different periscope positions in the plasma to obtain a two-dimensional correlation function in space and velocity difference. This correlation is directly related to the fluctuation spectrum through a Fourier transform. Measurements of these correlations are reported and discussed.

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