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Phase Space Velocy Correlation and Degrees of Freedom[1] SEAN MATTINGLY, JORGE BERUMEN, FENG CHU, RYAN HOOD, FRED SKIFF, University of Iowa — We measure the phase space distribution function's velocity correlation function $C(v, v', \tau) = \langle f(x, v, t) f(x' = x, v', t - \tau \rangle_t$ in a cylindrical axially magnetized laboratory plasma ($n \sim 10^9, T_e \sim 5eV, T_i \sim 0.08eV$) generated with an inductively coupled RF source. We use Laser Induced Fluorescence (LIF) with two lasers that each have their own atomic transition scheme and collection optics to simultaneously measure distinct ion subpopulations at differing velocities v and v'. A separately mounted antenna facilitates the velocity correlation measurement through either single mode excitation with a sinusoidal signal or broadband excitation with white noise. LIF photon acquisition is synchronized with digitizer sampling of the signal driving the fluctuation excitation antenna. With this we explore phase space degrees of freedom in v and v' with either monochromatic or broadband excitation. Finally, driving a sinusoidal wave near the ion cyclotron frequency causes linear wave - particle resonance $\omega - n\Omega_{ci} = k_{||}(\omega) v_{||}$ that results in a tunable ion resonance velocity located within the Doppler broadened IVDF - making it measureable by LIF.

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