

Abstract Submitted
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Direct measurement of the concentration of metastable ions produced from neutral gas particles using laser-induced fluorescence¹ FENG CHU, FRED SKIFF, JORGE BERUMEN, SEAN MATTINGLY, RYAN HOOD, University of Iowa — Extensive information can be obtained on wave-particle interactions and wave fields by direct measurement of perturbed ion distribution functions using laser-induced fluorescence (LIF). For practical purposes, LIF is frequently performed on metastables that are produced from neutral gas particles and existing ions in other electronic states. We numerically simulate the ion velocity distribution measurement and wave-detection process using a Lagrangian model for the LIF signal. The results show that under circumstances where the metastable ion population is coming directly from the ionization of neutrals (as opposed to the excitation of ground-state ions), the velocity distribution will only faithfully represent processes which act on the ion dynamics in a time shorter than the metastable lifetime. Therefore, it is important to know the ratio of metastable population coming from neutrals to that from existing ions to correct the LIF measurements of plasma ion temperature and electrostatic waves. In this paper, we experimentally investigate the ratio of these two populations by externally launching an ion acoustic wave and comparing the wave amplitudes that are measured with LIF and a Langmuir probe using a lock-in amplifier.

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