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Investigation of Electron-Neutral Collisions in Weakly Ionized Laser Plasma Using Two-Color Interferometry and Radar Scattering[1]
CHRISTOPHER LIMBACH, Texas A&M University — In weakly ionized plasmas, inelastic and elastic electron-neutral collisional phenomena play an important role in determining the plasma conductivity and EEDF, while also yielding electronic and vibrational excitation relevant to plasma chemistry. In a decaying plasma, such as those impulsively excited through electrical or laser discharge, electron-neutral collisions mediate the plasma decay process during the later stages. In this work, we investigate the role of electron-neutral collisions in a weakly-ionized, laser generated atmospheric pressure plasma. The collision rate is indirectly measured through 12 GHz radar scattering from the isolated plasma volume with heterodyne detection. Unique to our approach, the plasma density and neutral density are directly controlled for using complementary two-color interferometry measurements. Analysis of the dataset shows the collision rate decreases faster than the decay in plasma density. The results are discussed in relation to the effect of electron temperature and the influence of spatial inhomogeneity and plasma shielding on the radar measurements.

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