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Development of Laser-Collision Induced Fluorescence for Atmospheric Pressure Plasma Generated in Helium Atmospheres

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The implementation and demonstration of laser-collision induced fluorescence (LCIF) generated in atmospheric pressure helium environments is presented in this communication. As collision times are observed to be fast (~ 10 ns), ultrashort pulse laser excitation (< 100 fs) of the $2(3)S$ to $3(3)P$ (388.9 nm) is utilized to initiate the LCIF process. Both neutral induced and electron induced components of the LCIF are observed in helium afterglow plasma as the reduced electric field (E/N) is tuned from < 0.1 Td to over 5 Td. Under the discharge conditions presented in this study (640 Torr He), the lower limit of electron density detection is $\sim 10^{12}$ e/cm³. Spatial profiles of the $2(3)S$ helium metastable and electrons are presented as functions of E/N to demonstrate the spatial resolving capabilities of the LCIF method.

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