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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 ˜ 10ˆ12 e/cmˆ3. 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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