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Comparison of Non-Resonant and Resonant Preionization for Dual-Pulse Laser Plasma Ignition in Air[1] AZER YALIN, CARTER BUTTE, Colorado State University, Fort Collins, CO, USA, CIPRIAN DUMITRACHE, National Institute for Laser, Plasma and Radiation Physics, Bucharest, Romania — Laser ignition of fuel-air mixtures is of interest for a number of combustion applications. In particular, recent experimental and modeling studies have focused on preionization schemes, with dual pulses, owing to promising results relating to pulse energy requirements, extension of the lean limit and combustion efficiency when igniting fuel-air mixtures. In this submission we compare preionization via non-resonant 266 nm radiation versus resonant 287 nm radiation based on 2+1 resonance enhanced multi-photon ionization (REMPI) of molecular oxygen (with nanosecond duration pulses in both cases) using a combination of experimental and modeling approaches. Experimentally, we measure gas temperature and electron density via Rayleigh and Thomson scattering respectively, perform chemiluminescence imaging of the OH radical, and record pressure traces of combustion events. On the modeling side, we have developed a 2-D spatially resolved gas dynamic plasma model to capture the plasma kernel evolution. Using these tools we find that the REMPI approach can be attractive in terms of forming relatively high electron density plasmas (order 10^{18} cm^{-3}) with lower total pulse energies by a factor of ˜2.5 as compared to the non-resonant scheme. Differences in the plasma driven gas dynamics as well as ignition characteristics between the two schemes are also discussed.

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