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High-speed stereoscopic LIBS measurement of fuel droplet and laser induced plasma interaction[1] ATULYA KUMAR, YUE WU, CHRISTOPHER LIMBACH, Texas AM University — Investigation of flame kernel development of a single fuel micro-droplet gives insight into flame kernel development in spray combustion ignition. In this study, an electrodynamic balance is used to trap an electrically charged fuel droplet in space and with a 10 ns Q-switched Nd:YAG laser, a breakdown is localized either directly on the droplet or at a precisely selected nearby location. A stereo-imaging optical configuration allows for simultaneous LIBS diagnostics and high-speed imaging of two orthogonal views of the laser-droplet interaction. Spatially and temporally resolved spectral profiles are captured on an imaging spectrometer and applied toward measurements of electron number density and electron temperature. The resulting dataset is analyzed to understand the variation in plasma parameters as a function of the relative distance between the laser breakdown and micro-droplet. In addition, high-speed imaging of OH* chemiluminescence is used to study the incipient flame kernel evolution and the correlation between the peak OH* concentration and the rate of heat release for different separation distances between the plasma and droplet.

[1]Simultaneous high-speed imaging and LIBS diagnostics for fuel droplet interaction with laser induced plasmas

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