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Electron avalanche and spark evolution along laser path in resonant laser-induced ignition STEVEN ADAMS, Air Force Research Labooratory, Wright-Patterson AFB, BOYD TOLSON, AMBER HENSLEY, UES, Inc. — A multi-photon ionization scheme is studied that could provide laser-induced ignition within a high-voltage gap across an aircraft combustion chamber. The multi-photon resonant enhanced ionization (REMPI) technique could potentially be applied as a laser trigger from a compact low power laser source leading to breakdown and ignition of an aircraft air-fuel flow. In this experiment, an ultraviolet laser is passed through an aperture in the anode and into the flow chamber. The REMPI process forms an ionized channel between the electrodes and, with an applied electric field, eventually leads to breakdown precisely along the laser path. A delay time of 200 to 1000 ns between the laser pulse and breakdown event is typical for our range of conditions. High speed imaging and spectroscopic data reveal evidence of space charge regions and local field distortion within the interelectrode space during the delay time and a model is applied to simulate the electron avalanche process. Spatially resolved spectroscopic analysis identifies various regions and degrees of laser photoionization, electron impact ionization, radical species and gas heating during the delay time.

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