Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Feedback control of a combined two-fluid/electro-spray coaxial injector via real-time measurements and Principal Component Analysis RODRIGO OSUNA-OROZCO, NATHANAEL MACHICOANE, PETER HUCK, ALBERTO ALISEDA, University of Washington — We present an experimental study of the physics of gas-assisted atomization combined with electro-spray. We leverage a low dimensional representation of the spray, from light attenuation measurements, to implement feedback control in real-time. The laminar liquid stream is injected through a long straight metallic needle at the center of the turbulent gas jet. The liquid is electrically charged by a very strong electric field at the nozzle exit. We apply an external electric field along the spray development region, characterizing the ability of an external sideways force on the individual droplets to modify the structure of the spray in the midfield. We characterize the break-up dynamics using high-speed visualizations in the near field and the droplet sizes and velocities in the midfield using light interferometry. In the implementation of real-time control, we use optical attenuation of light traversing the spray downstream of the nozzle in the mid-field. Low dimensional representations of the radial liquid volume fraction profiles allow for real-time control of the spray based on actuation on the gas total and angular momentum as well as on the external electric field.

Rodrigo Osuna-Orozco
University of Washington

Date submitted: 30 Jul 2019 Electronic form version 1.4