Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Thermal imaging of levitated fresh and salt water drops during laser irradiation.[1] CODY BROWNELL, HARRISON BIGGS, United States Naval Academy — Simulation of high energy laser propagation and scattering in the maritime environment is problematic, due to the high likelihood of turbulence, fog, and rain or sea spray within the beam path. Considering large water drops (diameters of approximately 1-mm), such as those found in a light rain, an incident high energy laser will lead to rapid evaporation of the water drop as it traverses the beam path. In this work we present surface temperature measurements of a water drop obtained using a FLIR IR camera. The drop is acoustically levitated, and subject to a continuous wave laser with a wavelength of 1070-nm and a mean irradiance of approximately 800 W/cm^2. These measurements show that the steady-state surface temperature of the drop is well below the saturation temperature, and for pure substances the equilibrium temperature decreases with decreasing drop volume similar to observations with smaller aqueous aerosols. Temperature non-uniformity within the drop is also assessed from statistics of the surface temperature fluctuations. Preliminary results from irradiated salt water drops show notably different behavior from fresh water drops, including temperature spikes as the drop volume decreases and occasional nucleate boiling.

[1]Acknowledge support from ONR N00014-17-WX-00031

Cody Brownell
United States Naval Academy

Date submitted: 24 Jul 2017 Electronic form version 1.4