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Surface temperature measurements of a levitated water drop during laser irradiation[1] CODY BROWNELL, TIMOTHY TRACEY, United States Naval Academy — Simulation of high energy laser propagation and scattering in the maritime environment is problematic, due to the high liklihood of turbulence, fog, and rain or sea spray within the beam path. Laser interactions with large water drops (diameters of approximately 1-mm), such as those found in a light rain, have received relatively less attention. In this regime a high energy laser will rapidly heat and vaporize a water drop as it traverses the beam path, but the exact heating / vaporization rate, its dependence on impurities, and ancillary effects on the drop or surroundings are unclear. 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 500 W/cm^2. These measurements show that the steady-state surface temperature of the drop is well below the saturation temperature, yet based on the time history of the drop volume vaporization begins almost immediately upon laser strike. Inferences on the turbulence characteristics within the drop are also made from measurements of the fluctuations in the surface temperature.

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