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**Simultaneous Multiphase PIV of Capillary Waves on a High Velocity Liquid Jet** MATTHIEU ANDRE, PHILIPPE BARDET, The George Washington University — Relaxation of a laminar boundary layer below the free surface of a jet is inviscidly unstable and can roll-up which generates millimeter size waves. The latter largely modify important characteristics of jets such as heat and mass transfers between phases and can lead to breakup, or air entrainment. Two dimensional linear stability analysis predicts the initial disturbance wavelength and growth rate for inviscid flows; it does not take into account the effects of viscosity, non-linearity, or actual boundary layer profile. Because of the small temporal and spatial scales associated with this flow, few experimental data are available. Data acquisition is further complicated by the presence of a free surface with steep waves. The current experiment consists in a 20.3 mm $\times$ 146.0 mm water slab laminar jet flowing onto a transparent open-channel at a Reynolds number of 2.9 $\times$ 104 to 1.4 $\times$ 105. Two high speed cameras are employed to obtain velocity fields simultaneously in the liquid and in the gas phase with Particle Image Velocimetry (PIV). Fluorescent dye is added in the liquid in order to improve interface detection. Each phase is recorded at 10 kHz, leading to a temporal resolution of 100 $\mu$s and high magnification lenses give a spatial resolution of 200 $\mu$m. The results confirm the mechanism of formation of the short surface waves. Generation of surface vorticity is identified in high curvature regions. Knowledge of the velocities in both phases allows studying vorticity flux through the free surface. The latter stage of wave growth can be accompanied by the formation of a vortex pair in the liquid and air entrapment.

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