Weekly CEAFM Seminar: Spring 2016

JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Date: **Friday, April 22, 2016**

Time: 11:00 AM

Location: Gilman Hall # 50

Speaker: **Prof. Alexandra Techet** (Massachusetts Institute of Technology)

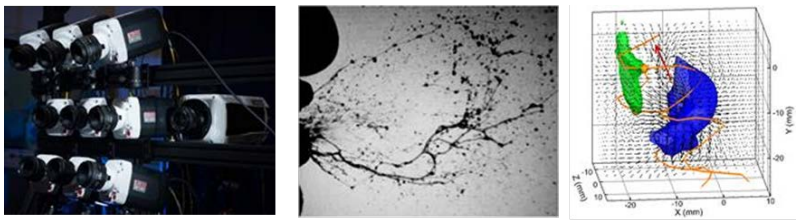
Title: ***"3D Light Field Imaging of Multiphase and Biological Flows"***

Abstract

The acquisition of both spatially and temporally resolved experimental data is one of the greatest challenges in solving real-world fluids engineering problems. Accurate experimental data is vital in order to develop useful models for, and assess the accuracy of, numerical simulations and design tools. Time-resolved, volumetric observational techniques that deliver highly accurate experimental data for unsteady hydrodynamic flows can provide critical insights for the design and understanding of a wide range of systems that operate in the marine environment, including surface ships, submarines, undersea projectiles, offshore oil platforms, and ocean energy systems.

To meet this compelling need, we have developed a new time-resolved, three-dimensional velocimetry method, based on light-field imaging and synthetic aperture refocusing methodologies. The novel three-dimensional, three-component (3D-3C) Light Field PIV method uses a multi-camera array to resolve volumetric flow fields, such as vortex rings and multiphase flows. Light Field PIV system represents the next generation of 3D PIV techniques and can have significant impact on the community due to the relatively low cost of image reconstruction and the ability to resolve densely seeded flow fields, to image near deformed interfaces, and to see through partial occlusions such as those found in multiphase flows. Spray flows can be optically dense, with a mix of fluid features such as ligaments and droplets. I will present the use of light field imaging (LFI) to reconstruct sprays in three dimensions (3D) over time, using an array of nine high-speed cameras. Synthetic Aperture Feature Extraction (SAFE) enables the extraction of feature sizes and spatial distributions in 3D LFI. For example the SAFE method can be used to analyze the mucosalivary fluid ejected during sneeze events include beads-on-a-string, multiple fluid bags, and distinct droplets; droplet centroids, radii, and other characteristics are determined in 3D over time.

This talk will demonstrate the versatility of lightfield PIV with results from two unique applications: biological human sneeze spray flows and aquatic propulsive wakes behind maneuvering and jumping fish.



a. b. c.

Figure: (a) 9-camera Light Field PIV array; (b) instantaneous image of a sneeze spray; (c) 3D reconstruction of a maneuvering fish wake.