

**CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING
SEMINAR SERIES**

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**High Resolution Measurements of Flow and Micro-Plankton Dynamics
in the Laboratory and in the Ocean Using Digital Holography**

The presentation introduces several examples where recent advances in digital holography enable measurements of flow structure and particle dynamics at unprecedented resolution. In the laboratory, digital holographic microscopy is being implemented to study the near-wall flow of a turbulent boundary layer over a smooth wall. The sample volume covers the viscous sublayer, buffer layer and lower portion of logarithmic layer. Resolution is sufficient for studying buffer layer structures and for measuring instantaneous wall shear stress distributions from velocity gradients in the viscous sublayer. Conditional sampling based on local shear stress magnitude identifies characteristic 3-D structures that generate extreme wall stress events as they lift away from the wall and associated length scales.

High-speed holographic cinematography is being used for studying swimming behavior of several marine organisms. The velocity field around a 1 mm copepod has a recirculating pattern in the copepod's frame of reference, which is caused by the combined effects of sinking and a propulsive force generated by the feeding appendages. Using Stokeslets to model this flow, it is possible to estimate the excess weight of the copepod and the propulsive force generated by its feeding appendages. The low Reynolds numbers associated with motion of 0.1 mm nauplius causes it to recoil as it brings its swimming appendages forward to propel itself. Characteristics of the generally helical but complex swimming of 10-30 μm dinoflagellates vary with introduction of prey into the sample volume. The presentation will conclude with introduction of a submersible, free drifting oceanic holography system. Data from recent deployments display behavior of and interactions among several organisms, such as a dinoflagellate escaping from a nauplius, and clouds of particles around swimming Appendicularians.

**TUESDAY – APRIL 10, 2007
Barus & Holley, Room 190
3:00pm**