JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

Weekly CEAFM Seminar: Fall 2013

Date: **Friday, October 25, 2013**

Time: 11:00 AM

Location: Gilman # 50 (Marjorie M. Fisher Hall)

Speaker: **Dr. Devesh Ranjan** (Texas A&M University)

Title: **"*Fluid Instabilities and Mixing in Extreme Conditions*"**

Abstract

Mixing is central to several important phenomena in nature and engineering. Rayleigh-Taylor (RT) and Richtmyer-Meshkov (RM) driven wrinkles at the interface of materials lie at the heart of an overarching science for material mixing that stretches from oil trapping salt domes, that develop over tens of millions of years, to degradation of Inertial Confinement Fusion (ICF) capsule performance in 10 -12 ns. Everyday phenomena include mixing of milk into coffee, and emptying of water from a glass. Technological and environmental applications include: drop disintegration in engine fuel sprays, enhanced heat transfer in tubes, plasma instabilities, material component mixing in the pharmaceutical industry, and buoyancy driven flows in the oceans and atmosphere. RT and RM are insidious instabilities that start with exponential growth of small scale perturbations, and end in a fully turbulent mixing process. It is this scale range and chaotic nature that challenges our experimental capabilities and physical understanding. But, the timely need to understand, predict, control, and utilize is because RT/RM mixing lies at the heart of national security priorities such as energy, threat reduction, and NNSA interests. Should the relationship between initial conditions and mixing be determined, then, in principle, the level of mixing could be controlled through the setting of specific conditions. In this seminar, I will describe the results from recent laboratory experiments for studying the shock-accelerated inclined interface problem and coupled RT & Kelvin-Helmholtz (KH) environment. Specifically, the effect of adding shear to a gravitationally unstable configuration will be discussed in detail. In these experiments, the flow visualizations are obtained using planar laser diagnostics (Mie-scattering and Planar laser-induced fluorescence). Simultaneous hot-wire and cold wire anemometry was implemented to obtain point-wise instantaneous velocities and density in the evolving flow field.