JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Friday, March 8, 2019
3:00 PM, 132 Gilman Hall

"Extreme Scale Computing in Turbulence: Physics and Algorithms"

Presented by Prof. P. K. Yeung
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It is well recognized that turbulence is an important subject in physical science and engineering applications, and that numerical simulations based on exact transport equations are an important source of insight into many of the underlying mysteries. In the high-performance community, direct numerical simulation of turbulence is also known as one of the most challenging pursuits, often requiring huge amounts of resources on state-of-the-art supercomputers characterized by massive parallelism. At the same time, as leadership-class computing enters the pre-Exascale era, an ability to adapt to changing architectures that may require re-imagining existing algorithms is very important, if not critical. In this talk I will first give a brief review of some of the fundamental questions in turbulent flow physics which motivate a need to continue pushing the boundaries for the foreseeable future. Then I will describe our group's recent experiences and progress in GPU-enabled parallel algorithms for two important problems: namely (1) the mixing of passive and active scalars at high Schmidt numbers relevant to oceanic conditions, and (2) the study of fine-scale intermittency in isotropic turbulence where we are aiming at grid resolution on the 200-Petaflop 'Summit' supercomputer at Oak Ridge National Laboratory. Other science targets, including studies of magnetohydrodynamic turbulence, will be addressed briefly, as well.