



# THE UNIVERSITY OF CHICAGO

Departments of Computer Science, Mathematics, and Statistics  
**SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR**

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## **DONGWOOK LEE**

The Flash Center for Computational Science  
The University of Chicago

## **High-Performance Scientific Computing for Today and Tomorrow**

**WEDNESDAY, January 23, 2013, at 2:30 PM**  
Ryerson 251, 1100 E. 58th Street

## **ABSTRACT**

Computational modeling in science and engineering relies on complex mathematical algorithms. The underlying mathematical models are carefully designed to enable large-scale computer simulations involving disparate scales of space and time. The resulting multiscale challenges frequently arise in representing multiphysical components by partial differential equations.

In this talk, I will illustrate some key ideas and challenges of computational mathematics in the framework of the FLASH code. FLASH is a highly-capable, massively parallel, publicly available open source scientific code with a wide user base in the fields of astrophysics, cosmology, and high-energy-density physics. I will discuss the accurate and stable numerical algorithms in FLASH that use traditional approaches based upon high-order polynomial interpolation. I will then introduce a new class of high-order hydrodynamic/MHD methods based on Gaussian Process modeling. These methods, which constitute an unusual pairing of PDE and statistical/probabilistic techniques, permit the formulation of fast convergent numerical schemes that will be crucial for future high-performance computing architectures.

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