PHYSICAL MATHEMATICS SEMINAR

High Order Computational Moment Methods for Radiative Transfer Simulations

BENJAMIN SEIBOLD

Temple University

ABSTRACT:

The Boltzmann equation of radiative transfer describes the propagation of photons or charged particles, and therefore is an important model for many applications in astrophysics, nuclear engineering, and cancer therapy. As a kinetic equation with a high dimensional phase space (time, position, velocity, energy), its accurate numerical approximation is a challenging problem, even in the presence of parallel compute architectures.

In this talk, we present a methodology to perform radiative transfer simulations by using a two-step process: first, the original kinetic equation is approximated by a moment method. We outline the idea of moment methods, and show recent work on nonlinear closures, such as maximum entropy and Kershaw closures. Second, the system of moments is approximated by high order numerical schemes. We present ongoing research on the application of discontinuous Galerkin methods, with a particular focus on the flexibility and parallel scalability of the schemes. Furthermore, we introduce a new, very elegant, Matlab code for linear moment methods, called StaRMAP, which represents our latest contribution towards fully reproducible computational research.

TUESDAY, MARCH 6, 2012
2:30 PM
Building 2, Room 105

Reception at 3:30 PM in Building 2, Room 290
(Math Dept. Common Room)

http://math.mit.edu/pms

Massachusetts Institute of Technology