TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

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High-Order Computational Moment Methods for Radiative Transfer Simulations

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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, as well as an elegant and efficient Matlab code for linear moment methods, called StaRMAP, which allows for fully reproducible radiative transfer computations.