The Nuclear Science and Technology Division

SEMINAR ANNOUNCEMENT

TITLE: **Spherical Harmonic-Based Methods for Time-Dependent Radiation Transport**

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DATE: **Monday, May 7, 2007**

TIME: **11:00 a.m.**

LOCATION: **Bldg. 5700, Room D307**

Time-dependent radiation transport arises in high-energy density physics when thermally radiated photons are emitted and absorbed by hot material. The numerical solution of the time-dependent transport equation using spherical harmonic-based discretizations of the angular variables will be discussed. Implicit time-differencing is appropriate to allow for large time steps in problems where the emission and absorption properties are changing more slowly. A finite volume discretization of space can be closed by using the solution of a Riemannn problem to provide the cell-boundary data.

This method can be made simultaneously monotone and second order in space away from extreme points by using a slope-limited interpolation scheme, resulting in a nonlinear system of equations at each time step. By using the min-mod limiter, the resulting nonlinear equations for each time step can be solved by the solution of two linear solves. In the thermal radiation transfer problem without material motion the temperature (material energy) equation can be treated fully implicitly. It is observed that the time-dependent spherical harmonics equations have some unexpected defects. In particular, the scalar flux can become negative in 2D. This is a property of the equations and not a numerical artifact. It can be traced to 4 properties: hyperbolicity, a finite number of degrees of freedom in the angular variable, rotational invariance, and linearity. Unless one of these properties is sacrificed, negative scalar fluxes can result.