MathCCES Seminar

Date: July 17, 13:30

Speaker: Jeff Haack, University of Texas at Austin

Title: Conservative Spectral method for Solving the Boltzmann Equation

Abstract:
We present a conservative spectral scheme for Boltzmann collision operators. This formulation is derived from the weak form of the Boltzmann equation, which can represent the collisional term as a weighted convolution in Fourier space. The weights contain all of the information of the collision mechanics and can be precomputed. I will present some results for isotropic (in angle) interations, such as hard spheres and Maxwell molecules. We have recently extended the method to take into account anisotropic scattering mechanisms arising from potential interactions between particles, and we use this method to compute the Boltzmann equation with screened Coulomb potentials. In particular, we study the rate of convergence of the Fourier transform for the Boltzmann collision operator in the grazing collisions limit to the Fourier transform for the limiting Landau collision operator. We show that the decay rate to equilibrium depends on the parameters associated with the collision cross section, and specifically study the differences between the classical Rutherford scattering angular cross section, which has logarithmic error, and an artificial one with a linear error. I will also present recent work extending this method for multispecies gases and gas with internal degrees of freedom, which introduces new challenges for conservation and introduces inelastic collisions to the system.