Slippery Rock University
Department of Mathematics and Statistics

Presents

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"Rigorously Showing Convergence of Solutions to a Mesoscopic Fluid-Particle Interaction Model to Solutions to a Macroscopic Model"

Abstract

The interaction of fluids and particles is of interest in fields of application such as biotechnology, medicine, waste-water recycling, and combustion theory. From physical principles, the interaction of a compressible fluid and a collection of identical particles can be modeled by a Navier-Stokes or Euler system coupled with a Vlasov-Fokker-Planck equation. In this system, the fluid is described by two functions of time and space: the density and the velocity. The particles are described at each point in time and space by a density function over the space of all possible microscopic velocity fluctuations. Past formal calculations have shown that when the time scale of measurement is large compared to the settling time of the particle velocity fluctuations, the solutions of this model converge to solutions to a Navier-Stokes or Euler system coupled with a Smoluchowski equation describing the evolution of the density of the particles.

In this talk, the two models will be described. We will then look at the relative entropy functional and how it is used in various contexts, particularly as a key tool in the analysis to prove the limit rigorously. Lastly, we will go over the estimates that lead to the convergence result.

Friday, Oct 23th
3:00 p.m.
https://sru.zoom.us/j/98352961875
Students are welcome!