THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS COLLOQUIUM

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Computational Deterministic Solvers for Chapman Kolmogorov Transport Equations for Binary Interactions

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Jones 226, 5747 South Ellis Avenue

ABSTRACT

Binary interacting particle transport, or kinetic collisional modeling, was introduced in the last quarter of the nineteenth century by L. Boltzmann giving birth to the area of Statistical Physics. This area raised by the search on establishing connections between thermodynamics and the dynamics of interacting particles or molecules in a probabilistic framework.

These types of evolution models concern a broad class of non-local, non-linearintegro-differential problems that can be framed in the modern Chapman-Kolmogorov models from a probabilistic approach, whose rigorous mathematical treatment and approximations are still emerging in comparison to classical non-linear PDE theory. Their applications range from rarefied elastic and inelastic gas dynamics, including very low temperature regimes for quantum interactions, collisional plasmas and electron transport in nanostructures, to self-organized or social interacting dynamics. These models share a Markovian framework of birth and death processes, under the regime of molecular chaos propagation. Their evolution and transport are usually described by equations of Boltzmann or Fokker-Plank-Landau type for binary interactions.

We will discuss recent progress in analytical and numerical methods covering form initial and boundary value problems, to long time dynamics, to stability and error estimates issues.

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