Abstracts

Professor Alexandre Bobylev (Keldysh Institute of Applied Mathematics, RAS, Russia)

Title: Higher equations of hydrodynamics

Abstract: We consider in this talk the problem of derivation and regularization of higher (in Knudsen number) equations of hydrodynamics. The author's approach based on successive changes of hydrodynamic variables is presented in more detail for the Burnett level. The complete theory is briefly discussed for the linearized Boltzmann equation.

Professor Mario Pulvirenti (University of Rome, Italy)

Title: On the microscopic solutions of the Boltzmann-Enskog equation

Abstract: N.N. Bogolyubov observed that the time evolution of the empirical measures associated to the hard sphere flow are solutions (called microscopic solutions) to the Boltzmann-Enskog (B-E) equation. See: Bogolyubov, N.N.: Microscopic solutions of the Boltzmann-Enskog equation in kinetic theory for elastic balls. Theor. Math. Phys. 24, 804–807 (1975). This is somehow surprising because, while the empirical measures are based on a time reversal particle flow, the B-E equation (at least for smooth solution) exhibits a free-energy functional decreasing in time. The Bogolyubov statement has not an obvious mathematical justification. I this talk I want to show how a more general notion of solution to the B-E equation, based on a suitable series expansion, admits, as solutions, the empirical measures. This is a joint work with Sergio Simonella and Anton Trushechkin.

Professor Niclas Bernhoff (Karlstad University, Sweden)

Title: Half-space problems in kinetic theory

Abstract: Half-space problems for the Boltzmann equation (BE) are of great importance in the study of the asymptotic behavior of the solutions of boundary value problems of the BE for small Knudsen numbers. They provide the boundary conditions for the fluid-dynamic-type equations and Knudsen-layer corrections to the solution of the fluid-dynamic-type equations in a neighborhood of the boundary. Together with A.V. Bobylev, we began to consider such half-space problems for the general discrete velocity model for single species in quite a general setting. Later it appeared that the abstract formulation of (some part of) the problem allowed generalizations to multicomponent mixtures, polyatomic molecules (with internal energies), bimolecular chemical reactions, quantum BE for bosons, fermions, and (partly) anyons, excitations near a Bose-Einstein condensate, relativistic BE, etc. of the obtained results. In this talk, we will review some results on half-space problems for the discrete kinetic equations, but also indicate some first steps in the study of a similar abstract formulation for half-space problems in the continuous case. The latter is based on discussions with F. Golse.

Professor Irina Potapenko (Keldysh Institute of Applied Mathematics, RAS, Russia)

Title: Kinetic simulation of heat transport in collision plasmas: stochastic and deterministic approaches

Abstract: We give some general remarks on stochastic and deterministic methods for kinetic equation of plasmas. Numerical simulations used standard splitting consider (a) continues motion of electrons and ions with self-consistent electrical field and (b) Coulomb collisions. For stochastic approach (a) PiC method and (b) Monte Carlo like method that models the Landau-Fokker-Planck equation are used (1D3V case). Deterministic modeling based on completely conservative finite difference schemes uses asymptotic-preserving approach. In this case 1D3V collision equation is considered. Important characteristic such as an energy flux is computed and efficiency of both approaches is discussed.

Professor Laurent Desvillettes (Université Paris Diderot, France)

Title: Chapman-Enskog asymptotics for a mixture of monoatomic and polyatomic gases

Abstract: For a reentry of a shuttle in the upper atmosphere, one has to take into account a mixture of monoatomic and polyatomic gases, because of the dissociation reactions of molecular oxygen and nitrogen. It is therefore useful to have a completely explicit Chapman-Enskog asymptotics in such a setting. Together with C. Baranger, M. Bisi and S. Brull, we provide a Boltzmann model and its asymptotics, fulfilling this requirement. We also present explicitly the set of compressible Navier-Stokes equations obtained at the limit.

Professor Huijiang Zhao (Wuhan University, China)

Title: Global in time Vlasov-Poisson-Boltzmann limit of the Vlasov-Maxwell-Boltzmann system

Abstract: We give a rigorous mathematical justification of the global in time limit from the Vlasov-Maxwell-Boltzmann system to the Vlasov-Poisson-Boltzmann system in the perturbative framework as the light velocity tends to infinity.

Professor Zhian Wang (The Hong Kong Polytechnic University, Hong Kong)

Title: Macroscopic limit of a kinetic model of chemotaxis with stiff response

Abstract: In this talk, we shall introduce the parabolic limit of kinetic model of chemotaxis with stiff response. Then we discuss the properties of the parabolic limit system such as global existence and asymptotic dynamics of solutions.

Professor Renjun Duan (The Chinese University of Hong Kong, Hong Kong)

Title: The Boltzmann equation in Besov spaces with spatially critical regularity

Abstract: We study the long-time behavior of solutions to the Cauchy problem on the nonlinear Boltzmann equation in the whole space whenever initial data is sufficiently close to a global Maxwellian in a velocity-weighted Besov space with spatially critical regularity. Both hard and soft potentials with angular cutoff are considered. Precisely, in case of hard potentials, we establish the global existence of mild solutions basing on the spectral analysis and the fixed point argument, and also obtain the polynomial rate of convergence provided that the initial perturbation additionally belongs to some Lebesgue space. The interesting point occurs in the case of very soft potentials where the result of the semigroup theory is not available, and we are still able to obtain the global-in-time mild solution by carrying out an interpolation technique combined with the time-decay properties for the linearized equation through the purely energy method. This is a recent work joint with Shota Sakamoto in Kyoto University.