Monday, February 3	
MORNING SESSION	**Chair: Alina Chertock (9:20 – Welcoming Remarks)**
9:30-10:10	**Shi Jin** **“***Asymptotic-preserving uncertainty quantification for transport equation with uncertain coefficients in the diffusive regimes*”
10:15-10:55	**Mohammed Lemou** **“***Uniformly accurate numerical schemes for highly oscillatory kinetic and Schrödinger equations*”
11:00-11:30	Break
11:30-12:10	Group Discussion
12:15-2:00	Lunch
AFTERNOON SESSION	**Chair: Giovanni Russo**
2:00-2:40	**Thomas Rey** “*Moment realizability-based hybrid numerical method for multi-scale kinetic equations*”
2:45-3:15	Break
3:15-3:55	**Frederic Coquel** *TBA*
4:00-5:00	Working groups, discussions

Tuesday, February 4	
MORNING SESSION	**Chair: Shi Jin**
10:00-10:40	**Lorenzo Pareschi** “*Asymptotic-preserving schemes for the Boltzmann equation*”
10:45-11:25	**Jingwei Hu** “*Asymptotic-preserving schemes for the semiconductor Boltzmann equation toward the energy-transport limit*”
11:30-12:10	Group Discussion
12:15-2:00	Lunch

AFTERNOON SESSION	**Chair: Thomas Rey**
2:00-2:40	**Jian-Guo Liu** "*Singular limit of a nonlinear hyperbolic system with a two-scale relaxation parameter at an interface*"
2:45-3:15	Break
3:15-3:55	**Cory Hauck** "*Discontinuous Galerkin methods for transport equations and the diffusion limit*"
4:00-5:00	Working groups, discussions
EVENING ACTIVITIES	
7:00	Dinner

Wednesday, February 5	
MORNING SESSION	**Chair: Lorenzo Pareschi**
9:30-10:10	**Alexander Kurganov** "*Asymptotic-preserving scheme based on hyperbolic decomposition for compressible Euler equations*"
10:15-10:55	**Debora Amadori** "*Error estimates for well-balanced and time-split approximations of balance laws*"
11:00-11:30	Break
11:30-12:10	Group Discussion
12:15-2:00	Lunch
AFTERNOON SESSION	**Chair: Daniel Balague**
2:00-2:40	**Giovanni Russo** "*Implicit-Explicit schemes for hyperbolic systems with diffusive relaxation*"
2:45-3:15	Break
3:15-5:00	Working groups, discussions

Thursday, February 6	
MORNING SESSION	
9:30-11:30	Working groups, discussions

ABSTRACTS

Shi Jin

Title. "Asymptotic-preserving uncertainty quantification for transport equation with uncertain coefficients in the diffusive regimes"

Abstract. In this talk we will study generalized polynomial chaos (gPC) approach to transport equation with uncertain cross-sections and show they can be made asymptotic-preserving, in the sense that in the diffusion limit the gPC scheme for the transport equation approaches to the gPC scheme for the diffusion equation with random diffusion coefficient.

Mohammed Lemou

Title. "Uniformly accurate numerical schemes for highly oscillatory kinetic and Schrödinger equations"

Abstract. This work is devoted to the construction of efficient numerical schemes for a wide class of highly oscillatory models including kinetic Vlasov models, nonlinear Schrodinger and Klein-Gordon equations. We present a general strategy to construct numerical schemes, which are uniformly accurate with respect to the oscillation frequency. This is a stronger future than the usual so called "Asymptotic preserving" property, the last being therefore satisfied by our scheme in the highly oscillatory limit. We show that our strategy enables to simulate the oscillatory problem without using any mesh or time step refinement, and we prove that the order of the scheme is preserved uniformly in all regimes. The method is based on a "double-scale" reformulation of the original equation, with the introduction of an additional variable. Then a link is made with well-known strategies based on Chapman-Enskog expansion in kinetic theory, which we extend to the dispersive context of Schrödinger-type equations.

Thomas Rey

Title. “**Title.** “Moment realizability-based hybrid numerical method for multi-scale kinetic equations”

Abstract. Many engineering problems involve fluids in transitional regimes (micro-electro-mechanical-systems, space shuttle reentry, ...). In these cases, the Euler or Navier-Stokes-like fluid description breaks down, typically due to shocks or boundary layers, and the use of a kinetic equation is needed to describe accurately the system. Nevertheless, this type of description is computationally expansive, and it is desirable to use it only locally, thanks to hybrid kinetic/fluid schemes. In this joint work with F. Filbet, I will present a new type of hybrid scheme, using the so-called moment realizability criterion (due to Levermore, Morokoff and Nadiga) to identify the kinetic zones, and apply it to many different multi-scales problems.

Lorenzo Pareschi

Title. “Asymptotic-preserving schemes for the Boltzmann equation”

Abstract. In this talk we review the developments of asymptotic-preserving schemes in the case of the Boltzmann equation. The common idea of the different approaches is to avoid the inversion of the expensive collision integral in stiff regimes close to the fluid-limit. For deterministic methods, some closely related problems, like the reduction of the velocity space to a bounded domain and the approximation of the equilibrium Maxwellian states, are also discussed.

Jingwei Hu

Title. “Asymptotic-Preserving Schemes for the Semiconductor Boltzmann Equation toward the Energy-Transport Limit”

Abstract. We design an asymptotic-preserving scheme for the semiconductor Boltzmann equation which leads to an energy-transport system for electron mass and internal energy as mean free path goes to zero. As opposed to the classical drift-diffusion limit where the stiff collisions are all in one scale, new difficulties arise in the two-scale stiff collision terms because the simple BGK penalization fails to drive the solution to the correct limit. We propose to set up a spatially dependent threshold on the penalization of the stiffer collision operator such that the evolution of the solution resembles a Hilbert expansion at the continuous level. Formal asymptotic analysis and numerical results confirm the efficiency and accuracy of our scheme. If time permits, I will talk about an alternative approach using the splitting strategy. This is joint work with Shi Jin and Li Wang.

Jian-Guo Liu

Title. "Singular limit of a nonlinear hyperbolic system with a two-scale relaxation parameter at an interface"

Abstract. In this talk, I will present a rigorous convergence analysis of a nonlinear hyperbolic system with a two-scale relaxation parameter at an interface. In the right part of the interface, the relaxation parameter is vanishing and we recover in the limit the underlying equilibrium PDEs, while in the left part, we deal with a finite relaxation rate. A relaxation layer develops within the interface in the asymptotic regime. Its Kruzkov like entropy analysis reveals the matching conditions in between the left and right PDEs models. The limit solution is proved to be bounded in sup norm with bounded total variation and the interface layer is monotone. This is joint work with Frederic Coquel, Shi Jin and Li Wang

Cory Hauck

Title. "Discontinuous Galerkin Methods for Transport Equations and the Diffusion Limit"

Abstract. In this talk, I will review the use of the discontinuous Galerkin (DG) method in capturing the diffusion limit of kinetic transport equations. One of the main drawbacks of this method is the large memory footprint. To address this issue, we have developed a new, low-memory approach that, among other things, includes a hybrid DG-finite volume scheme. Initial numerical analysis and preliminary numerical results will be presented to show the potential of the new approach.

Alexander Kurganov

Title. "Asymptotic Preserving Scheme Based on Hyperbolic Decomposition for Compressible Euler Equations"

Abstract. We propose an asymptotic preserving, that is, stable and sufficiently accurate for all Mach number, central-upwind scheme for the compressible Euler equations of gas dynamics. It is well-known that the main difficulty associated with numerical simulations of such models is amplification of the numerical viscosity for small Mach numbers, which leads to a severe restriction on the size of time steps and thus substantially affects the efficiency of the method. We propose to decompose the underlying system of equations into two well-posed hyperbolic systems to remove the stiffness and thus to reduce the numerical viscosity and increase the size of time steps. The proposed discretization provides a consistent approximation of both the hyperbolic compressible regime and the elliptic incompressible regime. We conduct a number of one- and two-dimensional

numerical experiments that demonstrate the asymptotic-preserving "all-speed" properties of the proposed central-upwind scheme.

Debora Amadori

Title. "Error estimates for well-balanced and time-split approximations of balance laws"

Abstract. The talk will review some recent results (in collaboration with Laurent Gosse) on the approximation of balance laws. We focus on the case of scalar balance laws and of two cases of 2×2 semilinear systems.

We consider two different approaches, namely the so-called Well-Balanced (WB) and the Fractional-Step (FS), and obtain L^1 error estimates for both approximations of the unique weak solution to the Cauchy problem. For the WB approach, the analysis relies on the original Bressan-Liu-Yang L^1-stability theory for homogeneous systems of conservation laws.

We shall discuss the qualitative difference between the two estimates, which is particularly effective when the dissipative or relaxation terms displays an explicit and significant dependence in the space variable.

Giovanni Russo

Title. "Implicit-Explicit schemes for hyperbolic systems with diffusive relaxation"

Abstract. The aim of the talk is to present some recent results on numerical schemes for hyperbolic systems with relaxation, which are able to capture the limit equation then the relaxation parameter vanishes. The diffusion limit describes the long time behavior of the system. In such a limit, the stiffness is both on the source term and on the hyperbolic term, so that the characteristic speeds diverge and standard methods that treat the hyperbolic term explicitly suffer from severe CFL condition dt < C epsilon*dx. Most methods in the literature will treat part of the hyperbolic term implicitly, thus relaxing to an explicit method for the underlying diffusion limit. A scheme with this property is called asymptotic preserving (AP).

Three main issues will be discussed in the talk. The first one is related on obtaining AP schemes with a completely explicit treatment of the hyperbolic term (in spite of the diverging characteristic speeds). The second deals with the construction of schemes that in the limit will relax to an implicit scheme for the underlying parabolic equation, thus overcoming the classic parabolic CFL condition dt < C * dx^2. The third one is devoted to semi-implicit schemes for the effective treatment of system, which relax to nonlinear diffusion equations. Several examples will illustrate the effectiveness of such approaches.