The 5th Korea-France Conference in Mathematics
Institut de Mathématique de Bordeaux
July 15-18 2025

Abstracts:
Partial Differential Equation and Probabilities

Thursday 11:00 - 11:50 **Aregba, Denise**

Affiliation: University of Bordeaux

Title: Convergence of lattice Boltzmann methods for conservation laws.

Abstract: The lattice Boltzmann method (LBM) is a family of numerical methods inspired by the kinetic approximation of fluid models. In the present work we use BGK vectorial equations to approximate a given conservation law. The transport part of the system is solved exactly and the nonlinear source term is treated explicitly by using one or more relaxation parameters. In this work we determine a set of parameters for which we prove that the method converges to the entropy solutions of a given conservation law.

Tuesday 14:00 - 14:50 **Bae, Hyeong Ohk**

Affiliation: Ajou University

Title: Existence for parabolic $p(x,t)$-Laplacian equation with non-continuous, unbounded p

Abstract: We consider a parabolic equation involving the $p(x,t)$-Laplacian as a prime term in a time-space cylinder $Q_T := \Omega \times (0,T) \subset \mathbb{R}^d \times \mathbb{R}, d \geq 2$. We assume that $p(x,t) : Q_T \to (1,+\infty)$ is a continuous function, except in a closed set of zero measure. Under the assumption that p is unbounded, such that $1 < \inf_{K\times(\delta,T)} p(x,t) \leq \sup_{K\times(\delta,T)} p(x,t) < \infty$ for every compact set $K \subset \Omega$ and $\delta \in (0,T)$, we prove the existence of a weak solution to the corresponding initial-and boundary-value problem for any given initial velocity in $L^2(\Omega)$.

Coworkers: Hermenegildo Borges de Oliveira (Univ of Algavre, Portugal), Jörg Wolf (Chung-Ang Univ, Republic of Korea)

Wednesday 12:10 - 12:30 **Bénéfice, Magalie**

Affiliation: Institut Elie Cartan de Lorraine

Title: Separation cut-off phenomenon for Brownian motions in harmonic manifolds

Abstract: The cut-off phenomenon for Markov processes is about the abrupt transition to equilibrium. During this talk, I aim to explain how this phenomenon can be studied in the case of Brownian motions in Riemannian manifolds by considering the absorption time of some well constructed dual processes with

domain values. In particular, I will give some results about the cut-off phenomenon for the separation distance in the case of some harmonic manifolds when the dimension becomes large.

Wednesday 9:50 - 10:10 **Bonamy Parrilla, Nathalie**

Affiliation: University of Bordeaux

Title: Numerical convergence of lattice Boltzmann schemes for parabolic problems under monotonicity conditions

Abstract: Many applications require solving parabolic equations, such as drift-diffusion equations for cold plasmas. Recent studies (see 4 have introduced Lattice Boltzmann schemes capable of handling parabolic problems, providing some stability results in simple cases with constant coefficients. On the other hand, the works 3 and 2 have demonstrated that Lattice Boltzmann schemes for hyperbolic cases converge when certain monotonicity conditions on the relaxation parameters are satisfied.

In this talk, we investigate Lattice Boltzmann schemes inspired by the Aregba-Natalini-Tang models (see 1) and analyze their potential numerical convergence under similar monotonicity conditions. Our objective is to extend existing theoretical results to a broader class of parabolic problems and assess the robustness of these schemes in practical applications.

1. Aregba-Driollet, Denise and Natalini, Roberto and Tang, Shaoqiang. Explicit diffusive kinetic schemes for nonlinear degenerate parabolic systems. Mathematics of computation, Vol. 245, (2004), 63–93.

2. Aregba-Driollet, Denise. Convergence of Lattice Boltzmann methods with overrelaxation for a nonlinear conservation law. ESAIM: Mathematical Modelling and Numerical Analysis, Vol. 58, No. 5 (2024), 1935–1958.

3. Aregba-Driollet, Denise and Bellotti, Thomas. Monotonicity and convergence of two-relaxation-times lattice Boltzmann schemes for a non-linear conservation law. arXiv preprint arXiv:2501.07934 (2025).

4. Dellacherie, Stéphane. Construction and analysis of lattice Boltzmann methods applied to a 1D convection-diffusion. Acta Applicandae Mathematicae, Vol. 131 (2014), 69–140.

5. Zhang, Zhihong and Li, Zhiqiang and Wu, Yunke. Advection–Diffusion lattice Boltzmann method with and without dynamical filter. Frontiers in physics, Vol. 10 (2022), p. 75628

Wednesday 11:00 - 11:50 **Chafaï, Djalil**

Affiliation: ENS Paris

Title: Aspects of the Cutoff Phenomenon for Diffusions

Abstract: The cutoff phenomenon, conceptualized in the context of finite Markov chains, states that for certain evolution equations, started from a point, the distance towards a long time equilibrium may become more and more abrupt in high dimensional state spaces and for certain choices of initial conditions. This can be seen as a critical competition between trend to equilibrium and initial condition. This talk is about the cutoff phenomenon for a few classes of linear and nonlinear diffusions. This is about joint works with Jeanne Boursier, and Cyril Labbé, with Max Fathi, and with Max Fathi and Nikita Simonov.

Wednesday 10:10 - 10:30 **Cho, Seung Yeon**

Affiliation: Gyeongsang National University

Title: A conservative semi-Lagrangian scheme for the ES-BGK model

Abstract: In this talk, we introduce a class of high order conservative semi-Lagrangian scheme (SL) for the ellipsoidal BGK model of the Boltzmann equation. To avoid the time step restriction induced by

the convection term, we adopt the semi-Lagrangian approach. For treating the nonlinear stiff relaxation operator with small Knudsen number, we employ high order L-stable DIRK or BDF methods. To ensure the conservation, we use a conservative reconstruction technique and weighted L^2-correction approach. Employing the special structure of relaxation operator, the implicit schemes are updated explicitly without any iterative solver, which guarantees the stability of the implicit methods and the efficiency of the explicit methods at the same time. We present numerical examples to demonstrate the accuracy and efficiency of the methods.

Thursday 9:50 - 10:10 **Choi, Jae-Hwan**

Affiliation: Korea Institute for Advanced Study (KIAS)

Title: Well-posedness and Large Deviations of Stochastic Lagrangian Flows with Applications to Nonlinear PDEs

Abstract: In this talk, I will present recent results on the well-posedness and large deviation principles for stochastic Lagrangian flows with singular coefficients. As applications, I will discuss the vanishing viscosity limit of the two-dimensional Navier–Stokes equations and the three-dimensional Vlasov–Poisson–Fokker–Planck equation. This talk is based on joint work with Chanwoo Kim, Dohyun Kwon, and Jinsol Seo.

Thursday 11:50 - 12:10 **Delande Loïs**

Affiliation: University of Bordeaux

Title: Semiclassical hypocoercivity and Eyring-Kramers law for degenerated Fokker-Planck operators

Abstract: We investigate certain Fokker-Planck operators and the Witten Laplacian in the low temperature regime, considering potentials that are not necessarily Morse. Our main focus is on the spectral behavior near zero of the associated operators, for which we aim to provide a precise characterization. Such a spectral description allows us to derive detailed insights into the long-time dynamics of the solutions, including quantitative results on return to equilibrium and metastability.

We begin with the analysis of the Witten Laplacian, a selfadjoint operator. Our approach involves adapting recent quasimode constructions to our non-Morse setting. Under a generic assumption on the degenerate potential, we successfully derive the desired spectral description.

Next, we turn to the Fokker-Planck operator with generalized degenerate coefficients. Here, degeneracy refers to the fact that the microlocal symbol of the operator is no longer locally quadratic. Leveraging the results obtained for the Witten Laplacian, we address the analytical challenges introduced by this degeneracy. Our strategy partly relies on resolvent estimates derived via hypocoercive techniques. As a result, we are once again able to establish an Eyring-Kramers-type formula for the spectrum of this operator.

Tuesday 15:10 - 16:00 **Dellarue, François**

Affiliation: University Côte d'Azur

Title: Regularization of Hamilton-Jacobi Equations in Mean Field Control

Abstract: Mean field control theory addresses control problems defined over large systems of weakly interacting particles. In the asymptotic regime—when the number of particles tends to infinity—the optimal value function solves a Hamilton-Jacobi equation posed on the space of probability measures. The goal of this talk is to introduce and study a regularized version of this Hamilton-Jacobi equation, using a Laplacian-type operator on the space of probability measures.

Thursday 10:10 - 10:30 **Desbouis, Kaplan**

Affiliation: University of Bordeaux

Title: On ergodic distribution dependent ergodic BSDE: existence, uniqueness and long-time behaviour of McKean-Vlasov control problem.

Abstract: In this talk, we will discuss about the existence and uniqueness to ergodic distribution dependent backward stochastic differential equation (BSDE) with an underlying weakly dissipative McKean-Vlasov SDE with multiplicative noise. We will also discuss about the long-time behaviour of the finite-horizon distribution dependent BSDE towards the ergodic distribution dependent BSDE. Finally, we will give an application to previous result to an optimal McKean-Vlasov ergodic control problem.

Tuesday 16:30 - 17h20 **Gallagher Isabelle**

Affiliation: ENS Paris and Université Paris Cité

Title: On the Cauchy problem for a class of quasilinear parabolic systems

Abstract: We are interested in a class of quasilinear parabolic systems in which the diffusion matrix is not uniformly elliptic, but satisfies the Petrovskii (or normal ellipticity) condition of positivity of the real part of the eigenvalues. Local well-posedness in $W^{1,p}$ for $d > p$ (where d is the dimension of space) has been known since Amann's work in the 90s, using a semi-group method. We revisit these results in the context of Sobolev spaces H^s for $s > d/2$, and more generally the critical Besov spaces $B^{d/p}_{p,1}$ for any p. This is a collaboration with Ayman Moussa.

Wednesday 14:00 - 14:50 **Golse, François**

Affiliation: Ecole polytechnique

Title: Numerical Analysis of the von Neumann Equation in the Semiclassical Regime.

Abstract: In quantum mechanics, the wave function $\psi(t,X) \in \mathbf{C}$ of a point particle of mass m subject to the force field deriving from the potential $V \equiv V(X) \in \mathbf{R}$ satisfies the Schrödinger equation

$$i\hbar\partial_t\psi(t,X) = -\frac{\hbar^2}{2m}\Delta_X\psi(t,X) + V(X)\psi(t,X)\,, \qquad \psi\big|_{t=0} = \psi^{in}\,.$$

The quantum Hamiltonian $\mathcal{H} := -\frac{\hbar^2}{2m}\Delta_X + V(X)$ is self-adjoint on L^2 for a suitable class of potentials V and the wave function $\psi(t,X)$ is given in terms of its initial value ψ^{in} by $\psi(t,X) = \exp(-\frac{it\mathcal{H}}{\hbar})\psi^{in}(X)$. Mixed quantum states involve statistical mixtures with weights $\lambda_0, \lambda_1, \ldots, \lambda_n, \ldots \geq 0$ of L^2-orthogonal systems of wave functions, of the form

$$R(t,X,Y) = \sum_{n\geq 0} \lambda_n \exp(-\tfrac{it\mathcal{H}}{\hbar})\psi^{in}(X)\overline{\exp(-\tfrac{it\mathcal{H}}{\hbar})\psi^{in}(Y)}\,, \qquad \text{where } \textstyle\sum_{n\geq 0}\lambda_n = 1\,.$$

The function $R(t,X,Y)$ is referred to as the "density matrix" and satisfies the von Neumann (or quantum Liouville) equation

$$i\hbar\partial_t R(t,X,Y) = -\frac{\hbar^2}{2m}(\Delta_X - \Delta_Y)R(t,X,Y) + (V(X) - V(Y))R(t,X,Y)\,.$$

In the semiclassical regime, the Planck constant $\hbar \ll 1$ the typical action of the particle, and computing numerically the propagator $\exp(-\frac{it\mathcal{H}}{\hbar})$ is a stiff problem which typically involves time steps Δt and spatial mesh size of order $\hbar$ or smaller. It was noticed already in 1 that time-splitting methods with time steps much larger than $\hbar$ lead to a good evaluation of observables (such as the mass, momentum, and energy densities), with uniform in $\hbar$ error estimates 3. However, these works leave aside the spatial discretization issue. Clever variants of the Gaussian wave packet method 4 help reducing the stiffness of the problem, but still require spatial mesh size of order $\sqrt{\hbar}$.

In this talk, we present a new approach 2 to the numerical analysis of the von Neumann equation which removes all stiffness as $\hbar \ll 1$. We discuss its validity and limitations, and illustrate it with some numerical test cases.

1. W. Bao, S. Jin, P.A. Markowich: On time-splitting spectral approximations for the Schrödinger equation in the semiclassical regime. *J. Comput. Phys.*, **175**, 487–524 (2002)

2. F. Filbet, F. Golse: On the approximation of the von-Neumann equation in the semi-classical limit. Part I: Numerical algorithm *J. Comput. Phys.*, **527**, 113810 (2025)

3. F. Golse, S. Jin, T. Paul: On the convergence of time splitting methods for quantum dynamics in the semiclassical regime. *Found. Comput. Math.*, **21**, 613–647 (2021)

4. G. Russo, P. Smereka: The Gaussian wave packet transform: efficient computation of the semi-classical limit of the Schrödinger equation. Part 1–formulation and the one dimensional case. *J. Comput. Phys.*, **233**, 192–209 (2013)

Wednesday 9:00 - 9:50 **Ha, Seung Yeal**

Affiliation: Seoul National University

Title: Clustering and spectral analysis of the Cucker-Smale model

Abstract: In this talk, we present clustering dynamics for the Cucker-Smale (CS) model and its connection to the graph Laplacian. For the infinite Cucker-Smal (ICS) model, we overcome the challenge of estimating the velocities of particles and derive a system of dissipative differential inequalities (SDDI) in terms of infinite norms. As in the finite ensemble, we show that mono-cluster flocking emerges exponentially fast, whereas we provide a sufficient framework for a multi-cluster flocking. For the CS model with a finite system size, we provide a complete characterization of multi-cluster flocking in terms of asymptotic behaviors of eigenvalues corresponding to the graph Laplacian of the CS model. Whereas for the ICS model, we first discuss the relation for asymptotic values of eigenvalues for the mono and multi-cluster flocking. In particular, we demonstrate that if infinite cluster flocking emerges for the ICS model, the limit of the infimum of the essential spectrum of the graph Laplacian approaches zero. Then, under the Cucker-Smale communication kernel, we offer a complete characterization of weak multi-cluster flocking in terms of asymptotic behaviors of eigenvalues corresponding to the graph Laplacian of the ICS model. Weak multi-cluster flocking means the relative distance between particles in the same cluster is always bounded concerning time. In contrast, the relative distance between particles in different clusters tends to infinity. This is a joint work with Dr. Xinyu Wang (Seoul National University) and Xiaoping Xue (Harbin Institute of Technology).

Friday 14:00 - 14:50 **Hérau, Frédéric**

Affiliation: University of Nantes

Title: kinetic equations with appearing walls

Abstract: We present first results on the long time behavior and diffusive limits for Langevin and overdamped langevin equations in the presence of extremely strong potentials. These potentials lead to walls at the limit and we will also explain how these results can be considered as first steps to the kinetic derivation of immiscible fluid equations. This is an ongoing work with Bérénice Grec and Hélène Mathis

Wednesday 16:30 - 16:50 **Hwang Gyuyoung**

Affiliation: Institute for Basic Science, Korea

Title: Existence of periodic measure-valued solutions to the nonlocal continuity equation via optimal transport

Abstract: We study the existence of periodic measure-valued solutions for a class of nonlocal continuity equations, which include the mean-field equations arising from the coupled systems of oscillators. We use a fixed point theorem for geodesically convex spaces constructed by optimal mass transport. Specifically, we construct an invariance set by obtaining dispersion estimates of probability measures via the push-forward by the characteristic flow, and we show the global existence of measure-valued solution from Schauder's fixed point theorem on geodesically convex spaces.

Thursday 14:00 - 14:50 **Kang, Jaehoon**

Affiliation: Hankyong National University

Title: Heat kernel estimates for symmetric jump processes with anisotropic jumping kernels

Abstract: In this talk, we will discuss heat kernel estimates for symmetric jump processes. We will first review some results on heat kernels for jump processes whose jumping kernels are comparable to isotropic functions. Then, we will consider jump processes with anisotropic jumping kernels and discuss their heat kernel estimates.

Friday 11:00 - 11:50 **Kang, Moon-Jin**

Affiliation: KAIST(Korea Advanced Institute of Science and Technology)

Title: Stability of small BV solutions to compressible Euler in a class of vanishing physical viscosity limits

Abstract: The stability of a Riemann shock, in the absence of any technical conditions for perturbations, is a major challenging problem even within a mono-dimensional framework. A physically natural approach to justify the stability of such a singularity involves considering a class of vanishing physical dissipation limits (or viscosity limits) of physical viscous flows with evanescent viscosities. I will present the recent result for the well-posedness theory of entropy solutions to the 1D isentropic Euler system evolving from small BV initial data in the class of inviscid limits from the associated Navier-Stokes system. More precisely, small BV entropy solutions to the isentropic Euler can be constructed by inviscid limits from Navier-Stokes, and those are unique and stable among inviscid limits from Navier-Stokes. The proof is based on the three main methodologies: the modified front tracking algorithm; the a-contraction; the method of compensated compactness.

Tuesday 14:50 - 15:10 **Kang Myeongju**

Affiliation: Gachon University

Title: A Consensus Based Optimization (CBO) algorithm for multi-objective optimization

Abstract: In this talk, we study a Consensus Based Optimization (CBO) algorithm for multi-objective optimization. In 2022, Borghi, Herty, and Pareschi proposed an extended CBO method based on a scalarization strategy, in which interacting particles search for the solutions of their own subproblems and approximate the Pareto front in finite time. Although this convergence was proved using a mean-field model, analysis on the particle model is essential for the practical application of the algorithm. Hence, we provide sufficient conditions for a particle model to form the Pareto front in finite time. Moreover, we observe the long time behavior to show the asymptotic consensus.

Friday 9:00 - 9:50 **Kim, Ildoo**

Affiliation: Korea University

Title: An existence and uniqueness theory to stochastic partial differential equations with pseudo-differential operators

Abstract: In this talk, we introduce a new weak formulation to guarantee existence and uniqueness of a solution to stochastic partial differential equations with pseudo-differential operators whose symbols are allowed to be sign-changing.

Wednesday 15:10 - 16:00 **Kim, Seonwoo**

Affiliation: Yonsei University

Title: Γ-Expansion of the Measure-Current Large Deviations Rate Functional

Abstract: In this talk, we present the general theory of connecting the hierarchical structure of metastability and the Γ-expansion of the measure-current (or level-2.5) large deviations rate functional of non-reversible finite-state Markov chains. The first bridge between the metastability and the Γ-expansion of the (measure, or level-2) rate functional was discovered recently by Bertini, Gabrielli and Landim (Ann. Appl. Probab. 2024). We briefly review the previous works on this topic and present

our own contributions. The talk is based on a recent work (arXiv:2412.13515) with Claudio Landim (IMPA).

Thursday 15:10 - 16:00 **Lee, Donghyun**

Affiliation: POSTECH

Title: Recent developments in Boltzmann boundary problems.

Abstract: We will present recent developments in the study of the (cutoff type) Boltzmann equation within physically bounded domains. Solutions to physical boundary value problems for the Boltzmann equation are generally understood to be non-smooth, and their analytic behavior is intricately tied to the geometry of the domain boundary. This discussion will include a review of current regularity results for Boltzmann boundary problems, alongside an examination of global solutions in low regularity function spaces that converge to equilibrium.

Friday 9:50 - 10:10 **Lee, Jaehun**

Affiliation: KAIST

Title: Stability of heat kernel estimates for symmetric jump processes on metric measure spaces.

Abstract: In this talk, we study symmetric pure jump Markov processes on metric measure spaces under volume doubling conditions. Our focus is on the stability of heat kernel estimates when the jumping kernel exhibits mixed polynomial growth. Unlike classical settings, the growth rate of the jumping kernel may not align with the scale function that determines near-and off-diagonal behaviors of the heat kernel. Assuming the lower scaling index of the scale function exceeds one, we establish the stability of heat kernel estimates under general conditions.

This talk is based on the joint work with Joohak Bae, Jaehoon Kang and Panki Kim.

Wednesday 11:50 - 12:10 **Lee, Jungkyoung**

Affiliation: Korea Institute for Advanced Study

Title: Metastability and Time Scales for Parabolic Equations with Drift

Abstract: Consider the initial-value problem on $\mathbb{R}^d$, given by

$$\begin{cases} \partial_t u_\epsilon \,=\, \mathscr{L}_\epsilon u_\epsilon \,, \\ u_\epsilon(0,\,\cdot) \,=\, f(\cdot)\,, \end{cases}$$

where f is a bounded continuous function, and $\mathscr{L}_\epsilon$ is the differential operator defined by

$$\mathscr{L}_\epsilon u \,=\, \boldsymbol{b}\cdot\nabla u + \epsilon\,\Delta u\,.$$

The behavior of the solution u_ϵ as $\epsilon \to 0$ is related to the metastable behavior of the corresponding diffusion process. In this talk, we discuss long-time behavior of u_ϵ in the small-noise limit, under the assumption that $\boldsymbol{b} = -\nabla U + \boldsymbol{\ell}$, where U is a smooth function and $\boldsymbol{\ell}$ is a vector field satisfying

$$\nabla U \cdot \boldsymbol{\ell} = 0 \quad \text{and} \quad \nabla\cdot\boldsymbol{\ell} = 0\,.$$

This is a necessary and sufficient condition for the diffusion process to have a Gibbs invariant measure of the form $Z_\epsilon^{-1} e^{-U(\boldsymbol{x})/\epsilon}\, d\boldsymbol{x}$.

Tuesday 11:30 - 12:30 **Lehec, Joseph**

Affiliation: University of Poitiers

Title: Concentration of measure in high dimensional convex sets

Abstract: In many situations, properties of high dimensional objects are governed by unifying principles. This high dimensional phenomenon, which emerged in the local theory of Banach spaces, has grown into a field of its own, with applications to many areas of mathematics, statistics and computer

science. In this talk, I will focus on the concept of concentration of measure, which was invented at the beginning of the 70s by V. Milman in its seminal proof of Dvoretzky's theorem, and more specifically on the role of convexity in this respect. I shall survey some important conjectures that fuelled this field of research with many developments and led to the discovery of new tools, such as Eldan's stochastic localization. Finally I will lay down the recent progresses regarding these conjectures.

Thursday 16:30 - 17:20 **Léonard, Christian**

Affiliation: University Paris Nanterre

Title: The Brownian bridge is a geodesic

Abstract: We show that the Brownian bridge is a geodesic in a curved spacetime where the space is that of probability densities equipped with Otto-Wasserstein geometry (quadratic optimal transport), and the curvature created by entropy appears only in the product structure of spacetime. We are guided by an analogy with the work of Elie Cartan, who in 1923 incorporated Newtonian gravitational theory into the framework of general relativity. The main tools are the notions of quadratic transport and entropic transport. This is a collaboration with Marc Arnaudon.

Friday 12:10 - 12:30 **Martin, Aymeric**

Affiliation: University of Bordeaux

Title: Stochastic parallel transport on the Wasserstein space over a closed Riemannian manifold.

Abstract: The stochastic parallel transport along a diffusion on a Riemannian manifold is obtained by solving locally a stochastic differential equation. The Wasserstein space $\mathcal{P}$ over a closed Riemannian manifold has a structure of infinite-dimensional Riemannian manifold with the difference that it is not locally diffeomorphic to a Hilbert space. The lack of local coordinates forces us to find another way to prove the existence and uniqueness along diffusions on $\mathcal{P}$. The problem of (deterministic) parallel transport was already treated by Gigli on $\mathcal{P}$, but the proof does not fit well with the stochastic setting. We present the existence and uniqueness of the stochastic parallel transport along diffusions on $\mathcal{P}_\infty$, the smooth Wasserstein space, by seeing the group of diffeomorphisms $\mathcal{D}$ as a Riemannian submersion onto $\mathcal{P}_\infty$.

Wednesday 14:50 - 15:10 **Park, Sungbin**

Affiliation: POSTECH

Title: Exponential Type Ill-Posedness Problem in the BGK Model and the Boltzmann Model.

Abstract: The Boltzmann and BGK models are important equations describing non-equilibrium statistical behavior of a thermodynamic system. The Boltzmann model was devised by Ludwig Boltzmann in 1872, and the BGK model was proposed as a computational friendly version of the Boltzmann model. In this talk, we will examine the different behavior between two models in exponentially weighted space including Gaussian weight. This is a joint work with Donghyun Lee and Seok-Bae Yun.

Thursday 12:10 - 12:30 **Park, Sungsu**

Affiliation: Sungkyunkwan University

Title: Convergence error estimate of a first-order finite difference scheme for the Vlasov-Poisson-BGK model.

Abstract: The Vlasov-Poisson-BGK model is a kinetic model that describes collisional plasma. This study presents a first-order finite difference scheme that is well-suited for working the Vlasov–Poisson–BGK model in either a rarefied or a fluid regimes. We then derive an convergence error estimate of this scheme in a weighted L^∞ norm.

Thursday 9:00 - 9:50 **Raimond, Olivier**

Affiliation: University Paris Nanterre

Title: An Averaging Principle for Stochastic Flows and Convergence of Non-Symmetric Dirichlet Forms

Abstract: We study diffusion processes and stochastic flows which are time- changed random perturbations of a deterministic flow on a manifold. Using non-symmetric Dirichlet forms and their convergence in a sense close to the Mosco-convergence, we prove that, as the deterministic flow is accelerated, the diffusion process converges in law to a diffusion defined on a different space. This averaging principle also holds at the level of the flows.

Joint work with Florent Barret (Université Paris Nanterre) based on the paper An Averaging Principle for Stochastic Flows and Convergence of Non-Symmetric Dirichlet Forms Potential Anal. 56, No. 3, 483-548 (2022).

Friday 10:10 - 10:30 **Rigal, Mathieu**

Affiliation: Sorbonne University

Title: Implicit kinetic scheme for the shallow water system

Abstract: When approximating the solutions of the shallow water system, it is important to verify certain discrete properties inherited from the continuous model, among which the positivity of the water height, the preservation of the lake at rest steady state, as well as the existence of an entropy inequality. Recently an explicit kinetic scheme has been proposed which satisfies all of the above properties, however the associated discrete entropy inequality contains an error term which does not always dissipate the energy, and can lead to entropy violating approximations. By considering its implicit version, we obtain a scheme which is always entropy dissipating, while preserving the other good properties of the explicit strategy.

Thursday 14:50 - 15:10 **Shahine, Marwa**

Affiliation: Eindhoven University of Technology

Title: Polyatomic Boltzmann Equation: Entropy-Based Ansatz for Galerkin Approximations

Abstract: In this work, we consider the Boltzmann equation modelling polyatomic gases, proposed by Bourgat et al. (1994). We propose an approximation of the distribution function based on Phi-divergences, and we prove that this approximation yields entropy stable closures leading to symmetric hyperbolic moment-systems. We then compare the properties of the proposed approximation in the Discontinuous Galerkin setting to available numerical results for some model problems.

Friday 11:50 - 12:10 **Yoon, jaeyoung**

Affiliation: Technical University of Munich

Title: Adaptive Cucker-Smale Networks: Limiting Laplacian Time-Varying Dynamics

Abstract: Differences in opinion can be seen as distances between individuals, and such differences do not always vanish over time. In this talk, we propose a modeling framework that captures the formation of opinion clusters, based on extensions of the Cucker Smale and Hegselmann Krause models to a combined adaptive (or co-evolutionary) network. Reducing our model to a singular limit of fast adaptation, we mathematically analyze the asymptotic behavior of the resulting Laplacian dynamics over various classes of temporal graphs and use these results to explain the behavior of the original proposed adaptive model for fast adaptation. In particular, our approach provides a general methodology for analyzing linear consensus models over time-varying networks that naturally arise as singular limits in many adaptive network models.