Etats de la Recherche SMF : Inégalités fonctionnelles

Conference Programme and Abstracts

16–20 November 2026

CIRM, France

Contents

1 Conference Schedule **2**
Day 1 – Monday . . . 2
Day 2 – Tuesday . . . 2
Day 3 – Wednesday . . . 3
Day 4 – Thursday . . . 3
Day 5 – Friday . . . 3

2 List of Abstracts **5**
2.1 Propagation of weak log-concavity along generalised heat flows via Hamilton-Jacobi equations . . . 5
2.2 Stability of entropic projections . . . 5
2.3 From deviation inequalities for eigenvalues to the rate of convergence of empirical measures . . . 5
2.4 From Generative Modeling to Schrödinger Bridges: Non-Asymptotic Convergence of Iterative Markovian Fitting. . . . 5
2.5 An invitation to the Γ-Stein method with an application to fluctuations of linear statistics of β-ensembles . . . 6
2.6 Sharp stability of Brenier potentials and its link to Poincaré inequalities . . . 6
2.7 Some recent activity on mean-field log-Sobolev motivated by stochastic algorithms . . . 6
2.8 A transport approach to the cutoff phenomenon . . . 7
2.9 Moment constrained stochastic dynamics . . . 7
2.10 An optimal constant for vector balancing with permutations . . . 7
2.11 Turnpike-type chaoticity in mean-field Schrödinger problems . . . 8
2.12 Functional inequalities for Markov chains on finite state spaces . . . 8

1 Conference Schedule

Day 1 – Monday

Time	Speaker	Title
09:25–10:55	Pierre Youssef	Functional inequalities for Markov chains on finite state spaces
11:25–12:25	Amélie Loher	TBD
14:00–15:30	Galyna Livshyts	Convexity, symmetry, the L^2 method and moment maps
16:00–17:00	Pierre Monmarché	Some recent activity on mean-field log-Sobolev motivated by stochastic algorithms
17:00–18:00	Songbo Wang	Turnpike-type chaoticity in mean-field Schrödinger problems

Day 2 – Tuesday

Time	Speaker	Title
09:00–10:00	Sandrine Dallaporta	From deviation inequalities for eigenvalues to the rate of convergence of empirical measures
10:25–11:25	Francesco Pedrotti	A transport approach to the cutoff phenomenon
11:25–12:25	Julien Reygner	Moment constrained stochastic dynamics
14:00–15:30	Giovanni Confort	Stability of entropic projections
16:00–17:00	Louis-Pierre Chaintron	Propagation of weak log-concavity along generalised heat flows via Hamilton-Jacobi equations
17:00–18:30	Cyril Imbert	TBD

Day 3 – Wednesday

Time	Speaker	Title
09:00–10:30	Galyna Livshyts	Convexity, symmetry, the L^2 method and moment maps
10:55–12:25	Pierre Youssef	Functional inequalities for Markov chains on finite state spaces

Day 4 – Thursday

Time	Speaker	Title
09:00–10:00	Marta Gentiloni-Silveri	From Generative Modeling to Schrödinger Bridges: Non-Asymptotic Convergence of Iterative Markovian Fitting

10:25–11:25	Ronan Herry	An invitation to the Γ-Stein method with an application to fluctuations of linear statistics of β-ensembles
10:25–12:25	Cyril Letrouit	Sharp stability of Brenier potentials and its link to Poincaré inequalities
14:00–15:30	Cyril Imbert	TBD
16:00–17:00	Shay Sadovsky	An optimal constant for vector balancing with permutations
17:00–18:30	Giovanni Conforti	Stability of entropic projections

Day 5 – Friday

Time	**Speaker**	**Title**
09:00–10:00	Joseph Lehec	TBD
10:30–11:30	Pierre Bizeul	TBD
11:30–12:30	Georg Menz	TBD

2 List of Abstracts

2.1 Propagation of weak log-concavity along generalised heat flows via Hamilton-Jacobi equations

Author: Louis-Pierre Chaintron
Affiliation: EPFL

Abstract. A well-known consequence of the Prékopa-Leindler inequality is the preservation of log-concavity by the heat semigroup. Unfortunately, this property does not hold for more general semigroups. In this talk, using reflection coupling for Brownian motions, I will present a slightly weaker notion of log-concavity that can be propagated along generalised heat semigroups. As a consequence, log-semiconcavity properties for the ground state of Schrödinger operators for non-convex potentials, propagation of functional inequalities along generalised heat flows and log-Hessian estimates for fundamental solutions can be obtained in non log-concave settings. This is a joint work with Giovanni Conforti and Katharina Eichinger.

2.2 Stability of entropic projections

Author: Giovanni Conforti
Affiliation: University of Padova

Abstract. Entropy minimization problems under marginal constraints play a central role in machine learning, data science, and computational optimal transport. Prominent examples include entropic optimal transport and the (regularized) Wasserstein barycenter problem. This mini-course presents some general principles for establishing quantitative stability of entropic projections. In particular, I will show how semiconcavity of the dual variables yields a form of entropic stability for the optimal plans, which in turn implies exponential convergence of the Sinkhorn algorithm with sharp rates. Time permitting, I will also discuss how to prove semiconcavity of the optimal potentials under geometric assumptions on the marginals

2.3 From deviation inequalities for eigenvalues to the rate of convergence of empirical measures

Author: Sandrine Dallaporta
Affiliation: Université de Poitiers

Abstract. This talk is concerned with the rate of convergence of empirical measures in Wasserstein distance. Starting from results on the global and local behaviors of eigenvalues of Hermitian random matrices, we will see how to get information about the rate of convergence for the empirical spectral distribution. Similar information may also be obtained for random matrices with complex eigenvalues. Focusing on dimension 2, we'll show that point processes satisfying some assumption on the p-th centered moment of the number of points in squares achieve the best possible rate for the empirical measure. This is based on a joint work with Raphaël Butez (Université de Lille) and David García-Zelada (Sorbonne Université).

2.4 From Generative Modeling to Schrödinger Bridges: Non-Asymptotic Convergence of Iterative Markovian Fitting.

Author: Marta Gentiloni-Silveri
Affiliation: Universität Heidelberg

Abstract. The Schrödinger Bridge (SB) problem has become a fundamental tool in computational optimal transport and generative modeling. To address this problem, ideal methods such as Iterative Proportional Fitting and Iterative Markovian Fitting (IMF) have been proposed—alongside practical approximations like Diffusion Schrödinger Bridge and its Matching (DSBM) variant. While previous work have established asymptotic convergence guarantees for IMF, a quantitative, non-asymptotic understanding remains unknown. In this talk, I will present the first non-asymptotic exponential convergence guarantees for IMF under mild structural assumptions on the reference measure and marginal distributions, assuming a sufficiently large time horizon. These results encompass two key regimes: one where the marginals are log-concave, and another where they are weakly log-concave. The analysis builds on new contraction results for the Markovian projection operator, classical functional inequalities, and arguments for the propagation of assumptions. The talk is based on a joint work with Giovanni Conforti and Alain Durmus.

2.5 An invitation to the Γ-Stein method with an application to fluctuations of linear statistics of β-ensembles

Author: Ronan Herry
Affiliation: Université de Rennes

Abstract. In the first part of this talk, mostly introductory, I will present the important idea of Stein kernels, that allows to establish quantitative CLTs. More precisely, they serve to establish an upper bound on the quantity $W_2(\mathrm{law}(F), \gamma)$ where F is a random variable defined on some probability space (Ω, A, P) and γ is a Gaussian measure. When the underlying probability space is equipped with a Markov diffusion that satisfies a Poincaré inequality, a systematic approach to quantitative CLTs has been developed. This has yield, among other, remarkable results for non-linear functionals of Gaussian fields.

In the second part of the talk, I will show how, with J. Angst, D. Malicet and G. Poly, we have adapted this idea to study the quantitative fluctuations of linear statistics of β-ensembles, which is a model of interacting particles on the line / eigenvalues of random matrices. The main difficulty is that the associated diffusion does not satisfy a Poincaré, but we have managed to adapt the approach. I will focus on ideas and possible adaptation to other models rather than on technicalities.

2.6 Sharp stability of Brenier potentials and its link to Poincaré inequalities

Author: Cyril Letrouit
Affiliation: Université Paris-Saclay

Abstract. We introduce a new functional inequality for uniformly log-concave measures, stronger than the Poincaré inequality. This new inequality bounds the variance of differences of convex functions and is motivated by the stability theory of optimal transport: for a fixed uniformly log-concave source measure, it provides a sharp stability bound for Brenier potentials with respect to variations of the target measure.

2.7 Some recent activity on mean-field log-Sobolev motivated by stochastic algorithms

Author: Pierre Monmarché
Affiliation: Université Gustave Eiffel

Abstract. Over recent years, many high-dimensional algorithms have been interpreted as gradient flows of some non-linear free energies over probability measures and their approximation by interacting particle systems. The convergence analysis of these algorithms then relies on log-Sobolev inequalities satisfied by the N-particle Gibbs measures and their non-linear versions corresponding to the mean-field limit. We will review some of the recent research activity motivated by this situation.

2.8 A transport approach to the cutoff phenomenon

Author: Francesco Pedrotti
Affiliation: ETH Zurich

Abstract. The cutoff phenomenon is a sharp transition in the convergence of high-dimensional Markov chains to equilibrium: the total variation distance remains close to 1 for a long time and then rapidly decreases to almost 0 over a much shorter time window. It was initially discovered in the context of card shuffling by Diaconis and Shahshahani, and it has since then been observed in a variety of different models. In spite of its ubiquity, it is still largely unexplained, and most proofs are model-specific. In this talk, we discuss a general approach to establishing cutoff based on transport inequalities, and we illustrate it with a few examples. Based on joint work with Justin Salez.

2.9 Moment constrained stochastic dynamics

Author: Julien Reygner
Affiliation: ENPC

Abstract.
We study a McKean—Vlasov equation which preserves some prescribed moments and converges to the minimizer of the relative entropy with respect to a reference measure under the moment constraint. Therefore, this dynamics can be seen as an MCMC approach to the so-called Gibbs principle. We discuss its interpretation as a constrained Wasserstein gradient flow, and show that exponential convergence holds under a uniform logarithmic Sobolev inequality over a suitable exponential family. Last, we show that this nonlinear SDE can be obtained as the mean-field limit of a system of interacting SDEs projected onto the manifold defined by the empirical moment constraints. This is a joint work with François Escolan and Rodrigue Lelotte, which has close connections with several other works in the literature, in particular by Eberle, Niethammer and Schlichting, and recently by Lempereur, Coeurdoux, Mallat and Vanden-Eijnden.

2.10 An optimal constant for vector balancing with permutations

Author: Shay Sadovsky
Affiliation: NYU

Abstract. Dvoretzky's vector balancing problem, posed in 1963, asks how small one can make the sum of a collection of vectors by choosing a sign for each vector. We present a version of the vector balancing problem in which each vector may be given a sign and a permutation of its coordinates. We prove that this vector balancing problem and its corresponding prefix problem admit an explicit bound, and we further show that it is asymptotically optimal in the dimension. Our method of proof relies on a geometric inequality, and hence accessible to a wide audience. Joint work with Jonathan Niles-Weed and Jacob Shkrob.

2.11 Turnpike-type chaoticity in mean-field Schrödinger problems

Author: Songbo Wang
Affiliation: Université Paris Dauphine-PSL

Abstract.
We study the long-time behavior of optimal particle systems for mean-field Schrödinger problems. Using first-order functional inequalities, we establish turnpike chaoticity: the influence of endpoint correlations decays exponen- tially away from both endpoints, up to finite-particle errors. These estimates yield uniform-in-time propagation of chaos for chaotic endpoints and genera- tion of chaos in the interior. The framework accommodates flat and geodesic convexity, as well as weak nonconvexity. For an equilibrium reference, we use the free-energy structure induced by an ergodic corrector to obtain near- optimal relaxation rates.

2.12 Functional inequalities for Markov chains on finite state spaces

Author: Pierre Youssef
Affiliation: NYU Abu Dhabi

Abstract. Functional inequalities relate global fluctuations to local variations measured along a dynamics. This mini-course introduces the Poincaré, modified log-Sobolev, and log-Sobolev inequalities for finite Markov chains, and connects them to convergence to equilibrium, mixing times, and concentration of measure. We will study their hierarchy and reverse comparisons, highliighting similarities and differences with diffusions. The course culminates in a comparison between the two log-Sobolev inequalities and a discussion of its applications.