Workshop analyse-probabilités dans le cadre du mois *Analyse et Interactions*

Septembre 2014

1 Timetable

Monday	*Tuesday*	*Wednesday*
Salle 112	*Salle Fokko du Cloux*	*Salle Fokko du Cloux*
$10h - 11h$ *break*	$9h30 - 10h20$ *Miclo*	$9h30 - 10h20$ *Doumic – Jauffret*
$11h - 11h50$ *Fournier*	$10h30 - 11h$ *pause*	$10h30 - 11h$ *break*
$12h - 12h50$ *Vovelle*	$11h - 11h50$ *Lepoutre*	$11h - 11h50$ *Bonnefont*
$13h - 14h30$ *lunch*	$12h - 12h50$ *Reygner*	$12h - 12h50$ *Monmarch*
$14h30 - 15h20$ *Kuwada*	$13h - 14h30$ *lunch*	$13h - 14h30$ *lunch*
$15h30 - 16h20$ *Malrieu*	$14h30 - 15h20$ *Canizo*	$14h30h - 15h20$ *JTugaut*
$16h30 - 17h$ *break*	$15h30 - 16h20$ *Lisini*	
	$16h30 - 17h$ *break*	
	$17h - 17h50$ *Lelievre*	
	$20h$ *dinner*	

2 Titles and abstracts

— **M. Bonnefont**
Title : *Spectral gap for spherically symmetric log-concave probability measures.*
Abstract : In this talk, we improve a well-known estimate due to Bobkov for the spectral gap of spherically symmetric log-concave probability measures on R^n. The proof is remarkably simple and relies on a convenient one-dimensional spectral gap estimate. Our approach can be extended beyond the log-concave case leading to weighted Poincaré inequalities.
(joint work with Alderic Joulin and Yutao Ma).

— **J. A. Cañizo**
Titre : *Entropy-entropy dissipation inequalities for the linear Boltzmann equation and related problems*

Résumé : We will present a recent joint work with Maria Bisi and Bertrand Lods where we show that the linear Boltzmann equation with a hard collision kernel satisfies an entropy-entropy dissipation inequality (for the logarithmic entropy). This inequality happens to be related to logarithmic Sobolev inequalities that can be obtained in the limit of grazing collisions. We will also give an overview of other open problems in mathematical physics where this type of inequalities are important, particularly in the context of coagulation-fragmentation equations.

— **M. Doumic-Jauffret**

Title : *A limit case for the fragmentation and growth-fragmentation equation (in collaboration with M. Escobedo)*

Abstract : the long-time asymptotics of the fragmentation and growth-fragmentation equations have been studied by many authors, proving convergence toward a steady behaviour under balance assumptions on the coefficients. Exponential speed of convergence has also been established under more restrictive assumptions. We focus here on a limit case where no such behaviour is possible, since the usual balance assumptions are not satisfied. We show that a specific dynamics emerge, where the initial condition continues to play a major role in the asymptotic profile.

— **K. Kuwada**

Title : *On the speed in transportation costs of heat distributions*

Abstract : By regarding heat distributions as a curve in the space of probability measures, we consider its speed measured by some transportation costs. This is a work in progress and our main concern in this talk is heat distributions on (backward) Ricci flow. The speed can be expressed explicitly when heat distribution is identified with a gradient flow of the relative entropy. On Ricci flow, this interpretation does not seem to work well. Nevertheless we can show some results for a suitably chosen transportation costs. By combining this result with monotonicity results on those transportation costs, we can show the monotonicity of Perelman's F-functional as well as W-entropy. Indeed it extends some known results in optimal transportation on Ricci flow to noncompact case.

— **T. Lelièvre**

Title : *Adaptive importance sampling techniques*

Abstract : We will present some mathematical results on adaptive techniques to sample multimodal distributions which have been introduced in computational statistical physics. The analysis of convergence and efficiency of these techniques rely on various tools : functional inequalities for PDEs, martingale convergence results applied to stochastic approximation algorithms, etc...

References : TL, M. Rousset et G. Stoltz, Long-time convergence of an

Adaptive Biasing Force method, Nonlinearity, 21, 1155-1181 (2008). G. Fort, B. Jourdain, E. Kuhn, TL et G. Stoltz, Convergence of the Wang-Landau algorithm, à paraître dans Mathematics of Computations G. Fort, B. Jourdain, E. Kuhn, TL et G. Stoltz, Efficiency of the Wang-Landau algorithm : a simple test case, à paraître dans AMRX.

— **T. Lepoutre**

Titre : *A 1D cell polarization model*

Résumé : We consider a toy model for spontaneous polarization. This a conservative drift diffusion model on the half line, the drift being given by the trace of the density at 0. This model exhibits different behaviour depending on the mass : self similar behaviour (diffusion wins) in a subcritical regime, convergence to a steady state in the critical case and finite time blow up in a supercritical regime. We will explore especially how to give quantitative estimate for the convergence and the blow up time.

— **S. Lisini**

Title : *Existence for full parabolic Keller-Segel system and energy dissipation inequality*

Abstract : In this talk I will show a construction of weak global solution for the full parabolic Keller-Segel model for chemotaxis in two dimensions. This result is based on a gradient flow interpretation of the system and its time discretization. An energy dissipation inequality is also obtained. This talk is based on a joint work with A. Blanchet, J. A. Carrillo, D. Kinderleherer, M. Kowalczyk, P. Laurençot.

— **N. Fournier**

Titre : *Vitesse de convergence de la mesure empirique en distance de Wasserstein.*

Résumé : En utilisant une idée de Dereich-Scheutzow-Schottstedt, on obtient des estimations optimales (sans parler des constantes) de $E[W_p^p(\mu_N, \mu)]$, si μ_N est la mesure empirique de N variables i.i.d. à valeurs dans R^d de loi commune μ. Les vitesses dépendent de p et d, (et du nombre de moments finis de μ).

On démontre aussi des inégalités de concentrations, c'est à dire qu'on majore $P[W_p(\mu_N, \mu) > x]$. Ces inégalités sont aussi satisfaisantes (presque), au niveau des ordres de grandeurs.

— **F. Malrieu**

Title : On the long time behavior of some piecewise deterministic Markov processes (few results and many questions)

— **L. Miclo**

Title : *Strong stationary times for one-dimensional diffusions*

Abstract : A strong stationary time associated to an ergodic Markov process X is a stopping time τ which is independent from the stopped position X_τ and such that X_τ is distributed according to the underlying invariant measure. We will present a necessary and

sufficient condition for the existence of strong stationary times for ergodic one-dimensional diffusions, whatever the initial distribution. The strong stationary times are constructed through intertwinings with dual processes, in the Diaconis-Fill sense, taking values in the set of segments of the extended line $\mathbb{R} \sqcup \{-\infty, +\infty\}$. They can be seen as natural h-transforms of the extensions to the diffusion framework of the evolving sets of Morris-Peres. Starting from a singleton set, the dual process begins by evolving into true segments in the same way a Bessel process of dimension 3 escapes from 0. The strong stationary time corresponds to the first time the full segment $[-\infty, +\infty]$ is reached. The benchmark Ornstein-Uhlenbeck process cannot be treated in this way, it will nevertheless be seen how to use other strong times to recover its optimal exponential rate of convergence in the total variation sense.

— **P. Monmarché**

Title : *Piecewise deterministic simulated annealing*

Et le résumé :

Abstract : To sample the Gibbs measure associated to a potential, a piecewise deterministic kinetic process is proposed. Although it seems too degenerated for functional inequality methods, a necessary and sufficient condition on the cooling schedule for a simulated annealing algorithm to converge is given, which is essentialy the same as in the diffusion case.

— **J. Reygner**

Title : *Multitype sticky particles and probabilistic solutions to hyperbolic systems of nonlinear PDEs*

Abstract : We study hyperbolic systems of nonlinear PDEs with monotone and bounded data. Without loss of generality, we assume that these data are cumulative distribution functions (CDFs) on the real line, and look for solutions that remain so at all time. Such solutions are called 'probabilistic solutions'.

In the scalar case, it is known that the probabilistic solution can be approximated by the empirical CDF of a system of sticky particles introduced by Brenier and Grenier, that is described as follows : particles travel on the real line at constant velocity and stick into clusters at collisions, with conservation of mass and momentum. Stability estimates on the probabilistic solution in Wasserstein distance were obtained by Bolley, Brenier and Loeper.

We introduce a multitype version of the sticky particle dynamics and use it to obtain the existence of a probabilistic solution for any choice of data, under a uniformly strict hyperbolicity assumption on the system. We then derive similar Wasserstein stability estimates. A key ingredient of our proof is a uniform L^p stability estimate on the evolution of the particle system.

Joint work with Benjamin Jourdain and Régis Monneau.

— **J. Tugaut**

Titre : *Convergence of a McKean-Vlasov diffusion*

Résumé : Le résumé : A McKean-Vlasov diffusion corresponds to a particle in a mean-field system of particles which dimension goes to infinity. Benachour, Roynette and Vallois have proved the convergence of this process. Cattiaux, Guillin and Malrieu have extended this result by adding the gradient of a convex potential. Carrillo, McCann and Villani prove a similar result in a non-convex case by assuming that the center of mass is fixed. By using the exact number of invariant probabilities and the free-energy functional, the long-time convergence will be proved by easily checked assumptions.

— **J. Vovelle**

Titre :*Invariant measure for first-order scalar conservation laws*

Résumé : We study the large time behaviour of solutions to first-order scalar conservation laws with stochastic force (as, for example, the non-viscous stochastic Burgers equation). We show the existence of an invariant measure and prove, under more restrictive hypotheses that it is unique and ergodic. This is a work in collaboration with Arnaud Debussche.