École d'hiver de probabilités
Semaine 1 : Mécanique statistique de l'équilibre

	Lundi	**Mardi**	**Mercredi**	**Jeudi**	**Vendredi**
09h45-10h45	Velenik	Velenik	Velenik	Velenik	Velenik
11h00-12h00	Presutti	Nachtergaele	Kupiainen	Marchand	Donati Martin
13h30-15h00	TD	TD		TD	14h00 - 15h00
15h15-16h00	Pfister	Ioffe		Procacci	Péché
16h00-16h45	Giuliani	Bissacot		Lacoin	15h00 - 16h00
17h00-17h45	Campanino	Ndreca		Théret	Scoppola

Y. Velenik (5 lectures): An introduction to statistical mechanics (+ 3 complement and exercise sessions).

E. Presutti: Phase transitions in particle systems and microstructures, in particular about particles models with short range interactions plus long range Kac potentials.

C. Pfister: One dimensional models.

A. Giuliani: Universality for non-integrable 2D Ising models: energy critical exponents and central charge.

We investigate a non solvable two-dimensional Ising model with nearest neighbor plus weak finite range interactions. We rigorously establish two properties of the critical theory:
(1) We prove and compute the existence of a scaling limit for the multipoint energy correlations, as the lattice spacing "a" goes to zero and the temperature goes to the critical one, with explicit bounds on the finite-"a" corrections.
(2) For ferromagnetic perturbations, we prove that at the critical temperature the finite size corrections to the free energy are universal, in the sense that they are exactly independent of the interaction. The corresponding central charge, defined in terms of the coefficient of the first subleading term to the free energy, as proposed by Affleck and Blote-Cardy-Nightingale, is constant and equal to 1/2.

These are two of the very few cases where the predictions of conformal field theory can be rigorously verified starting from a microscopic non solvable statistical model.

M. Campanino: Ornstein behavior for truncated correlation functions.

B. Nachtergaele: Gapped quantum phase and quantum phase transitions.

D. Ioffe: Stochastic representations of quantum spin states.

R. Bissacot: The Lovasz Local Lemma, the Lattice gas and the Shearer's measure.

We combine the connection discovered by Scott and Sokal em 2005 between the famous Lovasz Local Lemma used by the combinatorialists and the partition function of the lattice gas, with the criterion to the convergence of Cluster Expansion proved by Fernandez and Procacci in 2007 to obtain an improvement of this classical tool used in the Probabilistic Method. An introduction to the Probabilistic Method will be given as well to theory of lattice gases. The idea is to expose some of the main results of each topic and explain in details the connection between them, some recent applications and open problems.

S. Ndreca: Queues with Exponentially Delayed Arrivals

We study a discrete time queueing system where deterministic arrivals have i.i.d. exponential delays ξ_i. The standard deviation σ of the delay is finite, but its value is much larger than the deterministic unit service time; it turns out that the arrivals are negatively autocorrelated. We find the bivariate generating function for the system, and we solve the resulting boundary value problem in terms of a power series expansion in a parameter related to σ^{-1}. We also prove the analyticity of the generating function with respect to this parameter. The model, motivated by air and railway traffic, has been proposed by Kendall and others many decades ago, but no solution of it has been found so far.

A. Kupiainen: Logarithmically Correlated Random Energy Models

R. Marchand: Boolean percolation in high dimension.

In boolean percolation, random balls with iid random radii with common law ν are thrown with intensity λ in the space R^d, and we focus on the critical intensity $\lambda_c(\nu)$ required to percolate with these balls. It has been conjectured that the best way to percolate, i.e. to minimize the critical intensity, should be to use balls with constant radius. We prove that it is not the case, at least in high dimension: any non-degenerate distribution of radii, when correctly renormalized with respect to the dimension, is more efficient than constant radii as soon as the dimension is large enough.

A. Procacci: Percolation on infinite graphs and isoperimetric inequalities

We consider the Bernoulli bond percolation process (with parameter p) on infinite graphs and we give a general criterion for bounded degree graphs to exhibit a non-trivial percolation threshold based either on a single isoperimetric inequality if the graph has a bi-infinite geodesic, or two isoperimetric inequalities if the graph has not a bi-infinite geodesic. This new criterion extends previous criteria and brings together a large class of amenable graphs (such as regular lattices) and non-amenable graphs (such trees). We also study the finite connectivity in graphs satisfying the new general criterion and show that graphs in this class with a bi-infinite geodesic always have finite connectivity functions with exponential decay as p is sufficiently close to one. On the other hand, we show that there are graphs in the same class with no bi-infinite geodesic for which the finite connectivity decays sub-exponentially (down to polynomially) in the highly supercritical phase even for p arbitrarily close to one.

H. Lacoin: Counting self-avoiding paths on an infinite supercritical percolation cluster.

The self-avoiding walk on $\mathbb{Z}^d$ has been introduced by Flory and Ott as a natural model for polymers. In spite of the apparent simplicity of the model, mathematicians understanding is very far of being complete, in particular in low dimension (d=2,3,4). For this reason the disordered version of the model: Self-avoiding walk in a random potential has not received much attention from the mathematical community. On the other hand the model has received some attention in the Physics literature and some conjectures have been formulated. Our aim is to approach the problem by studying the asymptotic of the partition function. A particular case of interest is the one where the environment is given by supercritical Bernouilli percolation. We obtained so far two results: that when $d = 2$ the model is is never self-averaging even for small dilution in the sense that the number of open path is typically exponentially smaller than its average, and that the same phenomenon occur just above the percolation threshold in high dimension.

M. Théret: Maximal flow and minimal cut set in the first passage percolation.

C. Donati Martin: TBA.

S. Péché: TBA.

E. Scoppola: Sampling from a Gibbs Measure with Pair Interaction by Means of PCA.

We consider the problem of approximate sampling from the finite volume Gibbs measure with a general pair interaction. We exhibit a parallel dynamics (Probabilistic Cellular Automaton) which efficiently implements the sampling. In this dynamics the product measure that gives the new configuration in each site contains a term that tends to favour the original value of each spin. This is the main ingredient that allows one to prove that the stationary distribution of the PCA is close in total variation to the Gibbs measure. The presence of the parameter that drives the "inertial" term mentioned above gives the possibility to control the degree of parallelism of the numerical implementation of the dynamics.

École d'hiver de probabilités
Semaine 2 : Mécanique statistique des systèmes dynamiques et désordonnés

	Lundi	**Mardi**	**Mercredi**	**Jeudi**	**Vendredi**
09h45 - 10h45	Faggionato	Faggionato	Faggionato	Toninelli	Toninelli
11h00 - 12h00	De Masi	Vares	Toninelli	Saada	Jara
14h00 - 15h00	Gallavotti	Martinelli		Löcherbach	Svejda
15h00 - 16h00	Basile	Fontes		Avena	Gün
16h20 - 17h20	Orlandi	Simenhaus		Pulvirenti	Galves

A. Faggionato & C. Toninelli (6 lectures): Hierarchical coalescence processes: theory and applications.

A. de Masi: Particle system for the Stefan problem.

G. Gallavotti: Synchronization and fluctuations in non-Anosov systems: an example.

G. Basile: Large deviations of the empirical flow for a degenerate Markov jump process.

E. Orlandi: Minimizer for a random nonlocal functional with double-well potential.

M. E. Vares: First passage percolation and escape strategies

Consider first passage percolation on $\mathbb{Z}^d$ with passage times given by i.i.d. random variables with common distribution F. Let $t_\pi(u,v)$ be the time from u to v for a path π and $t(u,v)$ the minimal time among all such paths from u to v. We ask whether or not there exist points $x, y \in \mathbb{Z}^d$ and a semi-infinite path $\pi = (y_0 = y, y_1, ...)$ such that $t_p i(y, y_{n+1}) < t(x, y_n)$ for all n. Necessary and sufficient conditions on F are given for this to occur. This is a joint work with E. Andjel.

F. Martinelli: Glauber dynamics for various models of random surfaces.

L. R. Fontes: Trap models on $\mathbb{Z}^d$.

F. Simenhaus: Stochastic Ising model at zero temperature and Lifschitz law

Consider the stochastic Ising model at subcritical temperature in $\mathbb{Z}^d$ ($d \geq 2$). It has been conjectured by Lifschitz that a droplet of "$-$" in a "$+$" phase evolves in the diffusive scaling limit according to a motion by mean curvature. We are still far from proving such a result. Here we focus on the degenerate case $T = 0$. It has been proven recently that for every $d \geq 2$ the time for the droplet to collapse is of main order L^2 where L denotes the radius of the initial droplet. This result is a first step towards the proof of the conjecture. In the specific case $d = 2$, we go a step further : we derive, from the microscopic random dynamics the exact macroscopic anisotropic mean curvature motion as conjectured by Lifschitz. I will present results about mixing time in all dimensions and give more details about the proof of convergence for $d = 2$. This is a joint work with H. Lacoin and F.L. Toninelli.

E. Saada: Zero dissipation limit in the Abelian avalanche sandpile.

E. Löcherbach: TBA

L. Avena: Symmetric exclusion as a random environment: hydrodynamic limit.

E. Pulvirenti: Cluster expansion in the canonical ensemble.

M. Jara: Non linear fluctuations of interacting particle systems.

The two-blocks estimate is a well-known technical key step in the derivation of hydrodynamic limits and large deviations for interacting particle systems. We propose a version of the two-blocks estimate at the level of fluctuations, which allows to obtain various non-trivial scaling limits of one-dimensional, conservative systems. In particular, we show that fluctuations of conserved quantities of weakly asymmetric, one-dimensional conservative systems are governed by solutions of non-linear stochastic PDE's, among them the celebrated KPZ equation. The proof of the key two-blocks estimate is done through a renormalization scheme. Depending on the composition and/or interests of the audience, we will focus on the renormalization scheme on he simplest possible situation, or we will give a promenade around the different possible scaling limits of observables of the interacting particle system.

A. Svejda: Aging of dynamics in disordered systems.

O. Gün: Aging for dynamics of hierarchical spin glass models.

A. Galves: TBA.

CONFERENCE IN HONOR OF ETIENNE PARDOUX
MARSEILLE, FEBRUARY 18-22
PROGRAM

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	
9H00-9H50	LE GALL	MELEARD	MATTINGLY	**At CMI, IN FRENCH!**		9H00-9H50
				9H50-10H00: TORRESANI		
10H00-10H50	WAKOLBINGER	ETHERIDGE	ZEITOUNI	10H00-11H00: TALAY	KURTZ	10H00-10H50
PAUSE					PAUSE	
11H20-12h10	TALAY	COMETS	BISMUT	11H15-12H00: BONAMI	LYONS	11H20-12h10
PAUSE						
14H00-14H50			LIONS	14H00-14H30: BERTIN		
				14H30-15H00: DETRAZ		
15H00-15H50	NUALART	CARLEN	SOUGANIDIS	15H15-16H00: Former PhD Students		
16H00-16H50	BALLY	PIATNITSKY	PAUSE			
	PAUSE		16H30-17H20: EL KAROUI			
17H20-18H10	VERETENNIKOV	HAIRER	17H30-18H20: PENG			

Conference in honor of Etienne Pardoux.
Marseille, February 18-22, 2013.
Abstracts

BALLY Vlad (Univ. Paris Est) : A Hörmander type condition of order one for Wiener functionals.

We consider a Wiener functional $F = (F_1, ..., F_n)$ such that each F_i is four times differentiable in Malliavin sense and $\sigma(W_t, t \leq T)$ measurable. We assume that

$$\inf_{|\xi|=1} \sum_i \left\langle D_T^j F, \xi \right\rangle^2 + \sum_{i,j} \left\langle D_T^j D_T^i F - D_T^i D_T^j F, \xi \right\rangle^2 > 0$$

$D_T^j F$ is not precisely defined but we replace it with an appropriate limit. We prove that under the above non degeneracy condition the law of F is absolutely continuous with respect to the Lebesgue measure. If $F_i \in D^\infty$ then the density is of class C^∞.

This is a joint work with Lucia Caramellino.

BISMUT Jean-Michel (Univ. Paris 11) : Hypoelliptic Laplacian and Langevin process.

If X is a Riemannian manifold, the hypoelliptic Laplacian L_b is an operator acting on the total space $\mathcal{X}$ of the tangent bundle of X, that is supposed to interpolate between the elliptic Laplacian (when $b \to 0$) and the geodesic flow (when $b \to +\infty$). Up to lower order terms, L_b is a weighted sum of the harmonic oscillator along the fibre TX and of the generator of the geodesic flow. The operator L_b is a geometric version of a Fokker-Planck operator. Its probabilistic counterpart is a Langevin process. In this deformation, there are conserved quantities. In some cases, the full spectrum of the elliptic Laplacian is preserved by the deformation. In the talk, I will explain the underlying analytic and probabilistic aspects of the construction.

CARLEN Eric (Rutgers Univ.) : Probabilistic methods in kinetic theory : The Kac walk for large N.

The Kac walk is a N particle walk in a continuous state space that was introduced by Mark Kac to study the non-linear Boltzmann equation in the large N limit by considering marginals of his walk. Much progress has been made in recent years on obtaining information on the Kac walk that is uniform in N, and therefore yields information about the Boltzman equation.

This talk will present recent joint work with Carvalho and Loss, as well as work by a number of other authors.

COMETS Francis (Univ. Paris 7) : An information transmission model : combining Galton-Watson tree and the Coupon Collector.

We model the transmission of a message on the complete graph with n vertices and limited resources. The vertices of the graph represent servers that may broadcast the message at random. Each server has a random emission capital that decreases at each emission. Quantities of interest are the number of servers that receive the information before the capital of all the informed servers is exhausted and the exhaustion time. We establish limit theorems (law of large numbers, central limit theorem and large deviation principle), as $n \to \infty$, for the proportion of visited vertices before exhaustion and for the total duration. The analysis relies on a construction of the transmission procedure as a dynamical selection of successful nodes in a Galton-Watson tree with respect to the success epochs of the coupon collector problem.

Joint work with Francois DELARUE et Rene SCHOTT.

EL KAROUI Nicole (Ecole Polytechnique) : TBA

ETHERIDGE Alison (Univ. of Oxford) : Modelling natural selection.

HAIRER Martin (Univ. of Warwick) : Regularity Structures.

The classical way of measuring the regularity of a function is by comparing it in the neighbourhood of any point with a polynomial of sufficiently high degree. Would it be possible to replace monomials by functions with less regular behaviour or even by distributions ? It turns out that the answer to this question has surprisingly far-reaching consequences for building solution theories for semilinear PDEs with very rough input signals, revisiting the age-old problem of multiplying distributions of negative order, and understanding renormalisation theory. As an application, we build the natural "Langevin equation" associated with Φ^4 Euclidean quantum field theory in dimension 3.

KURTZ Thomas (Univ. of Wisconsin) : Strong and weak solutions for general stochastic models and time-change equations for diffusion processes.

Typically, a stochastic model relates stochastic "inputs" and, perhaps, controls to stochastic "outputs." A general version of the Yamada-Watanabe and Engelbert theorems relating existence and uniqueness of weak and strong solutions of stochastic equations will be given in this context. A notion of "compatibility" between inputs and outputs is critical in relating the general result to its classical forebears. Time-change equations for diffusion processes provide an interesting example. Such equations arise naturally as limits of analogous equations for Markov chains. For one-dimensional diffusions they also are essentially given in the now-famous notebook of Doeblin. Although requiring nothing more than standard Brownian motions and the Riemann integral to define, the question of pathwise uniqueness remains unresolved. To prove weak uniqueness, the notion of compatible solution is employed and the martingale properties of compatible solutions used to reduce the uniqueness question to the corresponding question for a martingale problem or an Ito equation.

LE GALL Jean-François (Université Paris-Sud et Institut universitaire de France) : The harmonic measure of critical Galton-Watson trees.

We consider simple random walk on a critical Galton-Watson tree conditioned to have height greater than n. It is well known that the cardinality of the set of vertices of the tree at generation n is then of order n. We prove the existence of a constant β belonging to $(0, 1)$ such that the hitting distribution of the generation n in the tree by random walk is concentrated with high probability on a set of cardinality approximately equal to n^β. In terms of the analogous continuous model, the dimension of harmonic measure of a level set of the tree is equal to β, whereas the dimension of any level set is equal to 1.

This is a joint work with Nicolas Curien.

LIONS Pierre-Louis (Collège de France) : TBA

LYONS Terry (Univ. of Oxford) : Cubature rough paths and the patched particle filter.

Many important algorithms involve transporting measures forward and it is an empirical fact that methods that approximate the measure by an empirical measure work effectively. In this talk we explain why Monte Carlo works badly in high dimensions (like 2 or 3) and explain other algorithms that out perform it.

This is a joint work with Wonjung Lee.

MATTINGLY Jonathan (Duke Univ. Durham) : TBA

MELEARD Sylvie (Ecole Polytechnique) : Stochastic modeling of Darwinian evolution : a stochastic multi-resources chemostat model.

We consider a stochastic model describing the Darwinian evolution of a polymorphic population with mutation and selection. The interactions between individuals occur by way of competition for resources whose concentrations depend on the current state of the population. Our aim is to model the successive fixations of successful mutants in the population and further its diversification on an evolutionary time scale. We prove, starting from a birth and death model, that, when advantageous mutations are rare and the population size large enough, the population process behaves on the mutation time scale as a jump process moving between successive equilibria. The main idea is a time scale separation : the time scale for the selection process to eliminate disadvantaged types has to be much smaller than the mutation time scale. Essential technical ingredients are the study of a generalized system of ODE's modeling a finite number of biological populations in a competitive interaction due to multi-resources and a fine description of the invasion and fixation of mutants using branching processes

This is a joint work with Pierre-Emmanuel Jabin and Nicolas Champagnat.

NUALART David (Univ. of Kansas) : Density formulas and applications to stochastic partial differential equations.

In this talk we will review explicit formulas for the density of random variables which are measurable with respect to an underlying Gaussian process, using the techniques of Malliavin calculus. As an application we will discuss upper and lower Gaussian bounds for the one-dimensional stochastic heat equation and we establish the Holder continuity of a solution to a nonlinear stochastic partial differential equation, arising from the asymptotic behavior of a particle system in a random environment.

PENG Shige (Shandong Univ.) : BSDE, PDE and Nonlinear Expectations v.s. Kigntian Uncertainty.

In 1921 Frank Knight has been clearly classified two types of uncertainties : the first one is for which the probability is known ; the second one, now called Knightian uncertainty, is for cases where the probability itself is also uncertain. The situation with Knightian uncertainty has become one of main concerns in the domain of data processing, economics, statistics, and specially in measuring and controlling financial risks. A long time challenging problem is how to establish a theoretical framework comparable to the Kolmogorov's one for probability, to treat these more complicated situations with Knightian uncertainties. The objective of the theory of nonlinear expectation rapidly developed in recent years is to solve this problem. This is an important program. Some fundamental results have been established such as law of large numbers, central limit theorem, martingales, G-Brownian motions, G-martingales and the corresponding stochastic calculus of Ito's type, nonlinear Markov processes, as well as the calculation of measures of risk in finance. But still so many deep problems are still to be explored. This new framework of nonlinear expectation is naturally and deeply linked to nonlinear partial differential equations (PDE) of parabolic and elliptic types. These PDEs appear in the law of large numbers, central limit theorem, and nonlinear diffusion processes in the new theory, and inversely, almost all solutions of linear, quasilinear and/or fully nonlinear PDEs can be expressed in term of the nonlinear expectation of a function of the corresponding (nonlinear) diffusion processes. Moreover, a new type of 'path-dependent partial differential equations' have been introduced which provide a PDE tool to study a stochastic process under a nonlinear expectation. Numerical calculations of these path dependent PDE will provide the corresponding backward stochastic calculations.

PIATNITSKI Andrey (Narvik Univ. & Lebedev Inst. : Homogenization of surface and length energies for spin systems.

SOUGANIDIS Panagiotis (Univ. of Chicago) : TBA.

TALAY Denis (INRIA Sophia) : Is Etienne forward or backward ?

I will present two recent results obtained with various co-authors which rely, one the one hand, on the Pardoux and Veretennikov papers on ergodic diffusions and elliptic

partial differential equations and, on the other hand, on the theory of backward stochastic differential equations.

VERETENNIKOV Alexander (Univ. of Leeds) : On McKean-Vlasov equations.

New results on existence and uniqueness and on asymptotic behaviour of solutions of stochastic McKean-Vlasov equations will be presented.

WAKOLBINGER Anton (Goethe Univ., Frankfurt) : Continuous branching with an asymmetric competition.

We consider a branching population with a linear ("left to right") order between contemporaneous individuals which is passed on to their offspring, and with pairwise fights which are always won by the individual to the left. In the diffusion limit with weak competition, the total population size follows a Feller branching diffusion with logistic drift, and the genealogy is described by a reflected Brownian motion with a "local time drift". We discuss the process indexed by the ancestral mass, and the corresponding Girsanov transforms. As an interesting by-product, we get insight into the distribution of the stochastic integral $\int_0^1 L_s^e(e_s)de_s$, where e is a normalized Brownian excursion.

This is joint work with Etienne Pardoux.

References :

- V. Le, E. Pardoux and A. Wakolbinger, "Trees under attack" : a Ray-Knight representation of Feller's branching diffusion with logistic growth, Probab Theory Relat Fields, Online First, 2012
- E. Pardoux and A. Wakolbinger, From Brownian motion with a local time drift to Feller's branching diffusion with logistic growth, Electron. Commun. Probab. 16 (2011), 720-731
- E. Pardoux and A Wakolbinger, From exploration paths to mass excursions - variations on a theme of Ray and Knight, in : Surveys in Stochastic Processes, J. Blath, P. Imkeller, S. Roelly (eds.), EMS 2011, pp 87-106.

ZEITOUNI Ofer (Weizman Inst & Univ. of Minnesota) : Einstein relation for the metropolis algorithm on a disordered tree and a conjecture of Aldous.

T he limiting speed of the right-most particle in a one-dimensional (discrete time, binary) branching random walk with negative-mean increments can be easily expressed in terms of the large deviations of the increments. Sampling efficiently (in a computational sense) particles that escape with positive velocity is however harder. In 1998, Aldous analyzed the Metropolis algorithm for sampling such particles, proved the existence of a temperature above which the asymptotic speed (= efficiency) of the algorithm vanishes, and conjectured, among other things, that for temperatures slightly below the threshold, the asymptotic velocity of the algorithm is positive, as soon as the asymptotic velocity of the BRW is positive. This part of Aldous' conjecture is equivalent to the validity of Einstein's relation for a certain random walk on a disordered tree. In joint work with Pascal Maillard, we establish the conjecture, in two steps. First we show, using homogenization techniques and regeneration estimates, that the asymptotic variance at the critical value

is strictly positive. Then, adapting an approach of Lebowitz-Rost (as in recent work of Gantert, Mathieu and Piatnitski), we establish the Einstein relation.

Modèles Stochastiques en Temps Long

Algorithmes Stochastiques

Interactions McKean-Vlasov

Dynamique moleculaire

Trois Mini-Cours

Pattrick Cattiaux (Toulouse)
Michel Benaim (Neuchâtel)
Gabriel Stoltz (ENPC)

Organisateurs

François Delarue (Nice)
Denis Talay (INRIA Sophia-Antipolis)

Exposés

Julien Barré (Nice)
François Bolley (Dauphine)
Mathieu Faure (GREQAM)
Jérôme Hénin (CNRS)
Benjamin Jourdain (ENPC)
Gilles Pagès (UPMC)

Planning

Inscription

Titres et résumés

Modèles Stochastiques en Temps Long

Titres et résumés

Michel Benaim, Neuchatel (Mini-cours)

Stochastic Algorithms.

Patrick Cattiaux, IMT, Toulouse (Mini-cours)

Some methods for the study of long time behaviour of stochastic dynamics. Application to McKean-Vlasov models.

In this mini-course we shall describe some of the usual methods for studying long time beahviour of diffusion type processes. The first talk will be devoted to give an overview of various methods (functional inequalities, coupling and transportation inequalities) applied to the simplest possible diffusion processes: drifted brownian motion. The role of convexity will be particularly explained. In the second one, we shall show how to extend these methods to more general diffusion processes including the case of interacting (linear) particle systems. The third talk will focus on McKean-Vlasov type models, both from the stochastic and from the analytic points of view.

Gabriel Stoltz, CERMICS, Ecole des Ponts and MICMAC project team, INRIA Rocquencourt (Mini-cours)

Molecular dynamics: a mathematical introduction

I will present some standard approaches in computational statistical physics, and the associated mathematical results and issues. I will start by recalling the general framework of statistical physics (microscopic description of systems, thermodynamic ensembles and computation of average properties). I will then focus on the canonical ensemble, which can be sampled with Metropolis-Hastings algorithms or using realizations of the Langevin dynamics. Metastability however often prevents a direct computation of average properties, so that importance sampling strategies have to be resorted to in order to reduce the variance of the estimators under consideration. I will present one possible strategy, based on the use of the free energy associated with some slowly evolving degree of freedom. Finally, I will discuss the estimation of transport coefficients (such as the thermal conductivity, the shear viscosity, or the autodiffusion coefficient) by equilibrium or nonequilibrium simulations.

Julien Barré, Laboratoire Dieudonné, Université de Nice

Cold atoms and non-linear Fokker-Plnack equations: modelin, theory and experiments. (Joint work with M. Chalony, B. Marcos and A. Olivetti from Nice and with D. Wilkowski from Nice and Singapur.)

In certain circumstances, a system of trapped cold atoms and quasi resonant lasers can be modeled as Brownian particles with effective long range interactions, and described by a non-linear Fokker-Planck equation. After briefly explaining the physical modeling, I will highlight two cases: (i) a quasi 1D trap where the effective interaction looks like 1D gravity, the theory can be compared to experiments done in Nice. (ii) a quasi 2D trap where the effective intercation does not derive from a potential and the non-linear Fokker-Planck equation may blow up in finite time.

François Bolley, Paris Dauphine (Exposé)

Long time behaviour for a McKean-Vlasov equation

We consider the issue of the long time behaviour of solutions to a McKean-Vlasov equation. When the exterior and interaction potentials are uniformly convex, then the solutions converge exponentially fast to a unique stationary solution, as shown by entropy dissipation and optimal transport techniques. Here we are interested in cases when the potentials are no more uniformly convex. This is joint work with I. Gentil (Lyon) and A. Guillin (Clermont-Ferrand).

Mathieu Faure, GREQAM, Marseille

Stochastic approximations and learning in Games (Exposé)

Stochastic approximations techniques, and in particular the ODE method, recently proved to be very useful in game theory, to predict the long run outcome in the situation of repeated interaction between players using adaptive strategies. After exposing the general framework, I will give some insights on two (more realistically one) recent result(s) in this context.

Benjamin Jourdain, CERMICS, ENPC (Exposé)

Optimal scaling of the transient phase of Metropolis Hastings algorithms (joint work with T. Lelièvre and B. Miasojedow)

We consider the Random Walk Metropolis algorithm on R^n with Gaussian proposals, and when the target probability measure is the n-fold product of a one dimensional law. It is well-known that, in the limit n tends to infinity, starting at equilibrium and for an appropriate scaling of the variance and of the timescale as a function of the dimension n, a diffusive limit is obtained for each component of the Markov chain. We generalize this result when the initial distribution is not the target probability measure. The obtained diffusive limit is the solution to a stochastic differential equation nonlinear in the sense of McKean. We prove convergence to equilibrium for this equation. We discuss practical counterparts in order to optimize the variance of the proposal distribution to accelerate convergence to equilibrium. Our analysis confirms the interest of the constant acceptance rate strategy (with acceptance rate between 1/4 and 1/3).

Jérome Hénin, IBPC, CNRS/UPMC (Exposé)

Echelles de temps dans les simulations moléculaires en biologie : problème et tentatives de solutions

La biologie est passée en quelques décennies de l'échelle macro et mésoscopique (tissus, cellules), à une approche principalement moléculaire, où nous cherchons à détailler les mécanismes du vivant atome par atome. Ces détails échappent aux microscopes les plus puissants, et ceux-ci sont de plus en plus remplacés par un "microscope numérique" : la simulation de dynamique moléculaire. Aux confins de la physique, de la chimie et de la biologie, les simulations donnent une bonne description atomistique de biomolécules comme les protéines, mais sont limitées à des échelles de temps de l'ordre de la microseconde. A cette échelle, les phénomènes intéressants correspondant à la fonction biologique des protéines sont des événements rares. Nous illustrerons des approches algorithmiques utiles pour observer ces événements rares dans le cadre de problèmes biologiques.

Gilles Pagès, UPMC (Exposé)

Approximation of a stationary diffusion and related problems