

Topics for Master Theses 2021

- **Fluctuation-dissipation theorem and sensitivity analysis**
 - Dembo, Deuschel: Markovian perturbation, response and fluctuation-dissipation theorem
 - Roussel, Stoltz: A perturbative approach to control variates in molecular dynamics
 - Assarif, Jourdain, Lelièvre, Roux: Computation of sensitivities for the invariant measure of a parameter dependent diffusion
 - Pavliotis: Stochastic processes, last chapter
- **Hypocoercivity**
 - Bernard, Fathi, Stoltz: Hypocoercivity with Schur complements
 - Cao, Lu, Wang: Explicit L2 convergence rate estimate for underdamped Langevin
 - Lu, Wang: Explicit convergence rate estimates for PDMP
- **Time reversal**
 - Cattiaux, Conforti, Gentil, Léonard: Time reversal of diffusion processes
 - Kazykina, Ren, Tan, Wang: Ergodicity of underdamped mean-field Langevin
 - Fontbana, Jourdain: Trajectorial interpretation of entropy dissipation and Fisher information for SDE
 - Föllmer: Time reversal on Wiener space
 - Haussmann, Pardoux: Time reversal of diffusions
- **Convergence to equilibrium for singular interactions**
 - Baudoin, Gordina, Herzog: Gamma calculus and explicit convergence estimates for Langevin
 - Herzog/Mattingly: Lyapunov for singular potentials
- **Mixing times**
 - Goel, Montenegro, Tetali: Mixing time bounds via the spectral profile
 - Montenegro, Tetali: Mathematical aspects of mixing times in Markov chains
- **Mixing times in statistical mechanics models**
 - Blanca, Caputo, Chen, Parisi, Stefankovic, Vigoda: On mixing of Markov chains: Coupling, spectral independence and entropy factorization
 - Blanca, Sinclair, Zhang: Critical mean field Chayes Machta dynamics
 - Bertini, Giacomin, Poquet: Synchronization and random long-time dynamics for mean field planar rotators
 - Ben Arous, Jagganath: Spectral gap estimates in mean field spin glasses
 - Chen, Liu, Vigoda: Optimal mixing of Glauber dynamics
- **McKean Vlasov equations**
 - Hammersley/Siska/Szpruch: McKean-Vlasov SDEs under measure dependent Lyapunov conditions
 - Al Rachid, Bossy, Ricci, Szpruch: New particle representations for McKean Vlasov SDE
- **Nonlinear filtering**
 - Stannat: Stability of the optimal filter
 - Kim, Taghvaei, Mehta, Meyn: Duality for nonlinear filtering
 - Kim, Mehta, Meyn: Conditional Poincaré for filter stability
 - Pathiraja, Reich, Stannat: McKean-Vlasov SDEs in nonlinear filtering
- **Neural networks**
 - Mei, Misakiewicz, Montanari: Mean-field theory of two layer neural networks
 - Hu, Ren, Siska, Szpruch: Mean-field dynamics and energy landscape of neural networks
 - Sirignano, Spiliopoulos: Mean-field analysis of neural networks
- **Stochastic Gradient Descent**
 - Cheng, Bartlett, Jordan: Quantitative CLT for discrete stochastic processes
 - Fehrmann, Gess, Jentzen: Convergence rates for SGD
- **Markov Chain Monte Carlo in high dimensions**

- Yang, Roberts, Rosenthal: Optimal scaling of Metropolis on general targets
- Chen, Dwivedi, Wainwright, Yu: Fast mixing of Metropolized HMC
- Mangoubi, Vishnoi: Nonconvex sampling with MALA
- Chewi, Lu, Ahn, Cheng, Le Gouic, Rigollet: Optimal dimension dependence of MALA
- **Multimodal sampling**
 - Syed, Bouchard-Côté, Deligiannidis, Doucet: Non-reversible parallel tempering
 - Syed, Romaniello, Campbell, Bouchard-Côté: PT on optimized paths
 - Dupuis, Wu: Analysis and optimization of certain parallel MC methods in low temperature limit
 - Choi: On the convergence of an improved simulated annealing algorithm via landscape modification
 - Arbel, Matthews, Doucet: Annealed flow transport Monte Carlo
- **Approximations in Wasserstein distances and statistical applications**
 - Nietert, Goldfeld, Kato: From smooth Wasserstein distance to dual Sobolev norm: Empirical approximation and statistical applications
 - Weed, Berthet: Estimation of smooth densities in Wasserstein distance
 - Fang, Shao, Xu: Multivariate approximations in Wasserstein distance by Stein's method and Bismut's formula
 - Gorham, Duncan, Vollmer, Mackey: Measuring sample quality with diffusions
- **Other selected topics**
 - Dizdar, Menz, Otto, Wu: Quantitative hydrodynamic limit of Kawasaki dynamics
 - Chatterjee: Universality of deterministic KPZ
 - Cortez, Fontbana: Quantitative uniform propagation of chaos for Maxwell molecules
 - Lee/Vempala: Eldan's stochastic localization and the KLS hyperplane conjecture
 - Chafai, Ferré, Stoltz: Coulomb gases under constraints
 - Legoll, Lelièvre, Sharma: Effective dynamics for non-reversible SDE
 - Mider, Jenkins, Pollock, Roberts, Sorensen: Simulating bridges using confluent diffusions
 - Mou, Flammerion, Wainwright, Bartlett: Improved Bounds for Discretization of Langevin Diffusions: Near-Optimal Rates without Convexity
 - Wu, Ma, Wainwright, Bartlett, Jordan: High order Langevin diffusion yields an accelerated MCMC algorithm
 - Le Chen, Koshnevisan, Nualart, Pu: Spatial ergodicity for SPDEs via Poincaré-type inequalities
 - Schmidt-Hieber: Nonparametric regression using deep neural networks
 - Baudel, Guyader, Lelièvre: Hill relation and mean reaction time
 - Wolfer, Kontorovich: Estimating the mixing time of ergodic MCMC
 - Li, Walker: A latent slice sampling algorithm
 - Bierkens, Grazi, van der Meulen, Schauer: Sticky PDMP samplers for sparse inference