

Topics for Master Theses 2022

a) Theory

- **Brownian transport**
 - Mikulincer, Shenfeld: The Brownian transport map
- **Mixing times**
 - Qin, Wang: Spectral telescope: Convergence rate bounds for Gibbs samplers based on a hierarchical structure
 - Caputo, Labbé, Lacoïn: Spectral gap and cutoff for Gibbs sampler of nabla phi interfaces
 - Lovasz, Winkler: Mixing times
 - Chen, Lovasz, Pak: Lifting Markov chains to speed up mixing
 - Blanca, Caputo, Chen, Parisi, Stefankovic, Vigoda: On mixing of Markov chains: Coupling, spectral independence and entropy factorization
 - Goel, Montenegro, Tetali: Mixing time bounds via the spectral profile
 - Montenegro, Tetali: Mathematical aspects of mixing times in Markov chains
- **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
- **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
- **Trajectorial entropy dissipation**
 - Fontbana, Jourdain: Trajectorial interpretation of entropy dissipation and Fisher information for SDE
 - Karatzas, Schachermayer, Tschiderer: A trajectorial approach to the gradient flow properties of Langevin–Smoluchowski diffusion
 - Tschiderer, Yeung: A trajectorial approach to relative entropy dissipation for McKean-Vlasov diffusions

b) Algorithms

- **Markov Chain Monte Carlo in high dimension**
 - Ma, Chatterji, Cheng, Flammarion, Bartlett, Jordan: Is there an analog of Nesterov acceleration for MCMC?
 - Lee, Vempala: Convergence rate of Riemannian Hamiltonian Monte Carlo and faster volume computation
 - 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
- **Schrödinger bridges, time reversal and sampling**
 - Chen, Chewi, Li, Li, Salim, Zhang: Sampling is as easy as learning the score
 - Huang, Jiao, Kang, Liao, Liu, Liu: Schrödinger-Föllmer Sampler
 - Bernton, Heng, Doucet, Jacob: Schrödinger bridge samplers
 - Cattiaux, Conforti, Gentil, Léonard: Time reversal of diffusion processes
 - Föllmer: Time reversal on Wiener space
 - Haussmann, Pardoux: Time reversal of diffusions
 - Kazeykina, Ren, Tan, Wang: Ergodicity of underdamped mean-field Langevin
- **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**
 - Fehrmann, Gess, Jentzen: Convergence rates for SGD
 - Cheridito, Jentzen, Rossmannek: Non-convergence of SGD in training of deep NN
 - Dereich, Kassing: Convergence of SGD for Łojasiewicz landscapes

c) Models

- **Mixing times in statistical mechanics models**
 - Bresler, Nagaraj, Nichani: Metastable Mixing of Markov Chains: Efficiently Sampling Low Temperature Exponential Random Graphs
 - Ding, Lubetzky, Peres: The mixing time evolution of Glauber dynamics for the mean-field Ising model
 - 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, Jagannath: Spectral gap estimates in mean field spin glasses
 - Chen, Liu, Vigoda: Optimal mixing of Glauber dynamics
 - Gheissari, Sinclair: Low-temperature Ising dynamics with random initialization
- **Mean-field systems and nonlinear SDE**
 - Delgadino/Gvalani/Pavliotis/Smith: Phase transitions, LSI and uniform in time propagation of chaos
 - Hammersley/Siska/Szpruch: McKean-Vlasov SDEs under measure dependent Lyapunov conditions
 - Al Rachid, Bossy, Ricci, Szpruch: New particle representations for McKean Vlasov SDE

d) Other papers of interest

- Arnaudon, Coulibaly-Pasquier, Miclo: Cutoff for Brownian motions on high dimensional spheres
- Biswas, Mackey: Bounding Wasserstein distances with couplings
- Garbuno-Inigo, Hoffmann, Li, Stuart: Interacting Langevin diffusions and Ensemble Kalman Sampler
- Barp, Takao, Betancourt, Arnaudon, Girolami: A unifying and canonical description of measure-preserving diffusions

- 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
- Chafai, Ferré, Stoltz: Coulomb gases under constraints
- Legoll, Lelièvre, Sharma: Effective dynamics for non-reversible SDE
- 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
- Baudel, Guyader, Lelièvre: Hill relation and mean reaction time
- Li, Walker: A latent slice sampling algorithm
- Bierkens, Grazi, van der Meulen, Schauer: Sticky PDMP samplers for sparse inference