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## **Invertible-flow non equilibrium sampling**

**Abstract** : Simultaneously sampling from a complex distribution with intractable normalizing constant and approximating expectations under this distribution is a challenging problem. We introduce a novel scheme, inspired by the the non-equilibrium sampling introduced by (Rotskoff and Vandeneijnden (2019), called Invertible Flow Non Equilibrium Sampling (InFine). InFine departs from classical Sequential Monte Carlo (SMC) and Markov chain Monte Carlo (MCMC) approaches. InFine constructs unbiased estimators of expectations and in particular of normalizing constants by combining the orbits of a deterministic transform started from random initializations. When this transform is chosen as an appropriate integrator of a conformal Hamiltonian system, these orbits are optimization paths. InFine is also naturally suited to design new MCMC sampling schemes by selecting samples on the optimization paths. Additionally, InFine can be used to construct an Evidence Lower Bound (ELBO) leading to a new class of Variational AutoEncoders (VAE).