

Subsampling I – Stochastic Gradient HMC

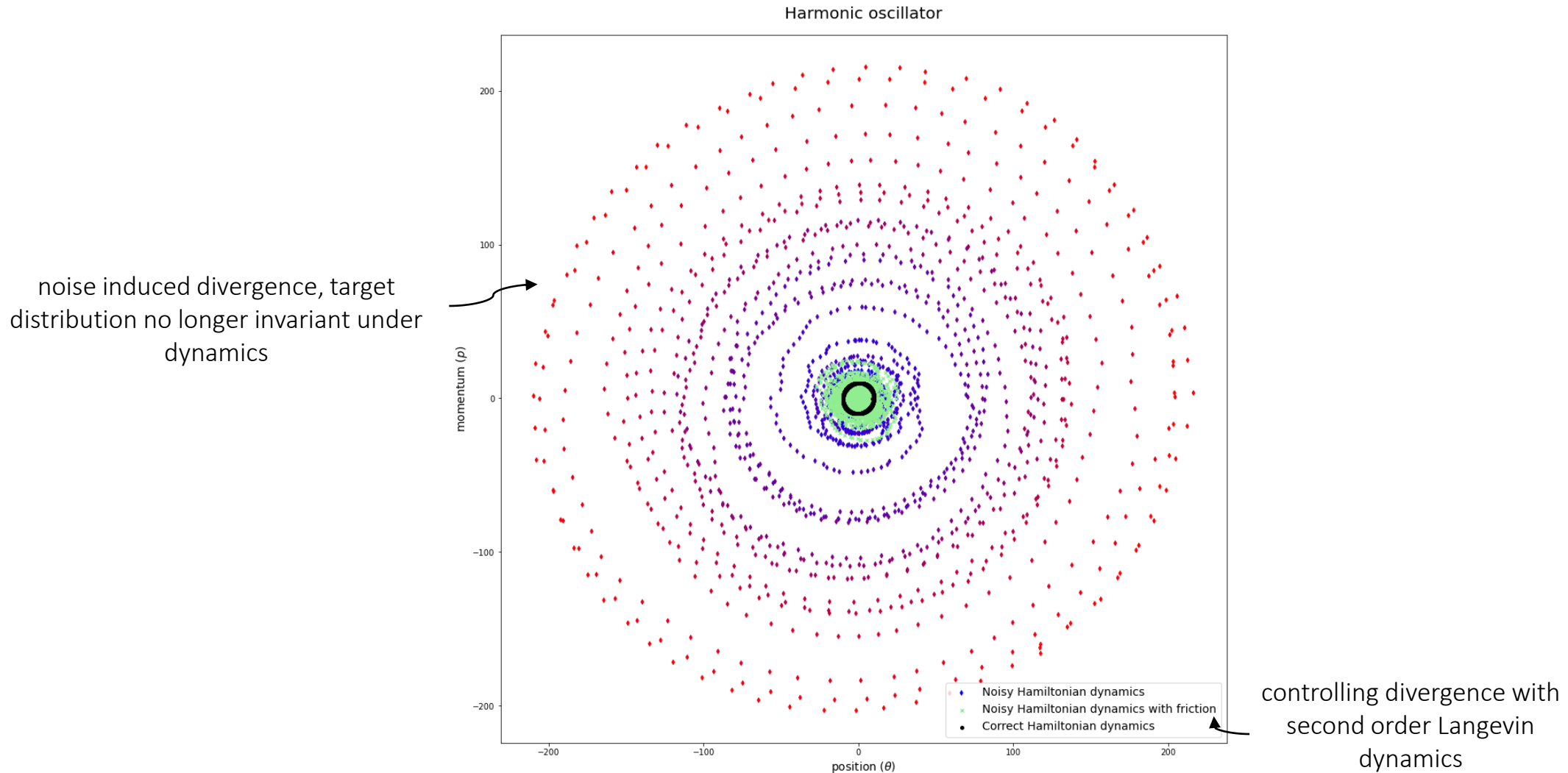
$$\nabla \tilde{U}(\theta) = -\frac{|\mathcal{D}|}{|\tilde{\mathcal{D}}|} \sum_{x \in \tilde{\mathcal{D}}} \nabla \log p(x|\theta) - \nabla \log p(\theta), \quad \tilde{\mathcal{D}} \subset \mathcal{D}.$$

$$\begin{cases} d\theta = M^{-1}r \, dt \\ dr = -\nabla U(\theta) \, dt - BM^{-1}r \, dt + \mathcal{N}(0, 2B \, dt). \end{cases}$$

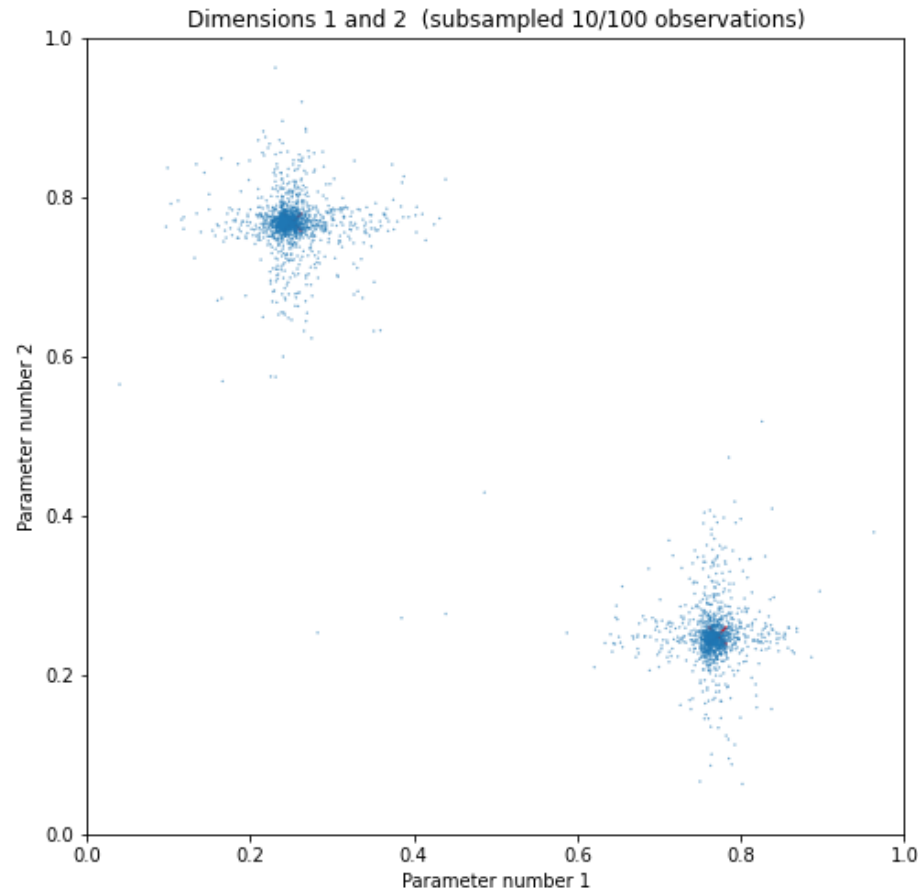
$$\begin{cases} d\theta = M^{-1}r \, dt \\ dr = -\nabla U(\theta) \, dt - CM^{-1}r \, dt \\ \quad + \mathcal{N}(0, 2(C - \hat{B}) \, dt) + \mathcal{N}(0, 2B \, dt) \end{cases}$$

Skip Metropolis-Hastings acceptance/rejection step, control induced error by keeping HMC integration stepsize small

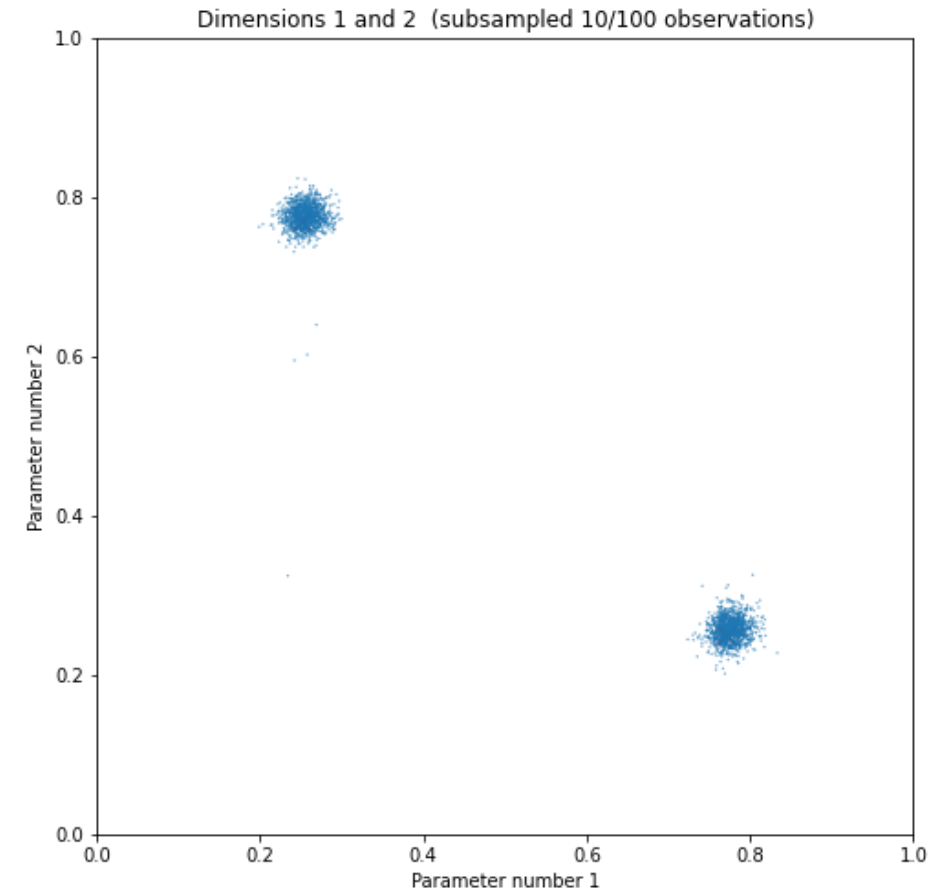
Noisy hamiltonian dynamics: oscillator



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No compensations ($B=0, C=0$)



Introduced friction ($B=500, C=1500$)