# Standard Notations

If you come across something that isn't in the list that is likely to come up, add it and post the document on slack/GitHub again so we're all aware of the update.

Put notes or things that need to be changed inside plus signs so that Ctrl+F can be used to find. E.g. +++ Insert reference to foo here +++ . Also allows you to highlight uncertain areas for other people to check.

| | |
|---|---|
| Diffusion | $X_t$ |
| Brownian Motion/Wiener Process | $W_t$ |
| Potential | $U : \mathbb{R}^d \to \mathbb{R}$ |
| Random Variables | Uppercase math font e.g. $X, Y, Z$ |
| Normalisation Constant | mathcal Z i.e. $\mathcal{Z}$ |
| Iteration | $X_k$ |
| Step Size | $h$ |
| Taming Function | $T$ |
| Stationary/Target/ True distribution | $\pi$ |
| Normal random variables | $Z$ |
| Minimum function | $\wedge$ i.e. $\min\{t, s\} = t \wedge s$ |
| Maximum function | $\vee$ i.e. $\max\{t, s\} = t \vee s$ |
| Dimension | $d$ |
| Proposed step | $Y$ |
| Lipschitz constant | $L$ |
| Strong convexity constant | $m$ |
| Number of iterations | $N$ |
| Startpoint | $X_0 = x_0$ |

The first ten are Langevin Monte Carlo (LMC) algorithms. Try and drop subscript where possible, it is ugly.

| **Algorithm** | **Name** | **Stationary Distribution** |
|---|---|---|
| Unadjusted Langevin Algorithm | `ULA` | $\pi^\gamma_{\text{ULA}}$ |
| Tamed Unadjusted Langevin Algorithm | `tULA` | $\pi^\gamma{}_{\text{tULA}}$ |
| Coordinatewise Tamed Unadjusted Langevin Algorithm | `tULAc` | $\pi^\gamma{}_{\text{tULAc}}$ |
| | | |
| Metropolis Adjusted Langevin Algorithm | `MALA` | $\pi^\gamma_{\text{MALA}}$ |
| Tamed Metropolis Adjusted Langevin Algorithm | `tMALA` | $\pi^\gamma_{\text{tMALA}}$ |
| Coordinatewise Tamed Metropolis Adjusted Langevin Algorithm | `tMALAc` | $\pi^\gamma_{\text{tMALAc}}$ |
| Metropolis Adjusted Langevin Truncated Algorithm | `MALTA` | $\pi^\gamma_{\text{MALTA}}$ |
| | | |
| Higher Order Langevin Algorithm | `HOLA` | $\pi^\gamma_{\text{HOLA}}$ |
| Tamed Higher Order Langevin Algorithm | `tHOLA` | $\pi^\gamma_{\text{tHOLA}}$ |
| Coordinatewise Tamed Higher Order Langevin Algorithm | `tHOLAc` | $\pi^\gamma_{\text{tHOLAc}}$ |
| | | |
| Leimkuhler-Matthews Algorithm | `LM` | $\pi^\gamma_{\text{LM}}$ |
| Tamed Leimkuhler-Matthews Algorithm | `tLM` | $\pi^\gamma_{\text{tLM}}$ |
| Coordinatewise Tamed Leimkuhler-Matthews Algorithm | `tLMc` | $\pi^\gamma_{\text{tLMc}}$ |
| | | |
| Random Walk Metropolis Algorithm | `RWM` | $\pi^\gamma_{\text{RWM}}$ |

Assumptions on drift coefficient (taming)

**A1** For all $h > 0, G_h$ is continuous. There exist $\alpha \geq 0, C_\alpha < +\infty$ such that for all $h > 0$ and $x \in \mathbb{R}^d$,

$$\|G_h(x) - \nabla U(x)\| \leq hC_\alpha(1 + \|x\|^\alpha).$$

**A2** For all $h > 0$,

$$\liminf_{\|x\| \to \infty} \left[ \left\langle \frac{x}{\|x\|}, G_h(x) \right\rangle - \frac{h}{2\|x\|} \|G_h(x)\|^2 \right] > 0$$