

High-D Substrate

$$X \in \mathbb{R}^D$$

*asymmetric
(low symmetry)*

Φ

Low-D Representation

$$Y = \Phi(X) \in \mathbb{R}^k$$

*dimensional
reduction*

Q

Heat Bath

$$T$$

*entropy
increase*

$$W_{\text{diss, min}} \geq k_B T (\ln 2 \Delta I + C_\Phi)$$

ΔI : information removed

C_Φ : geometric contraction cost