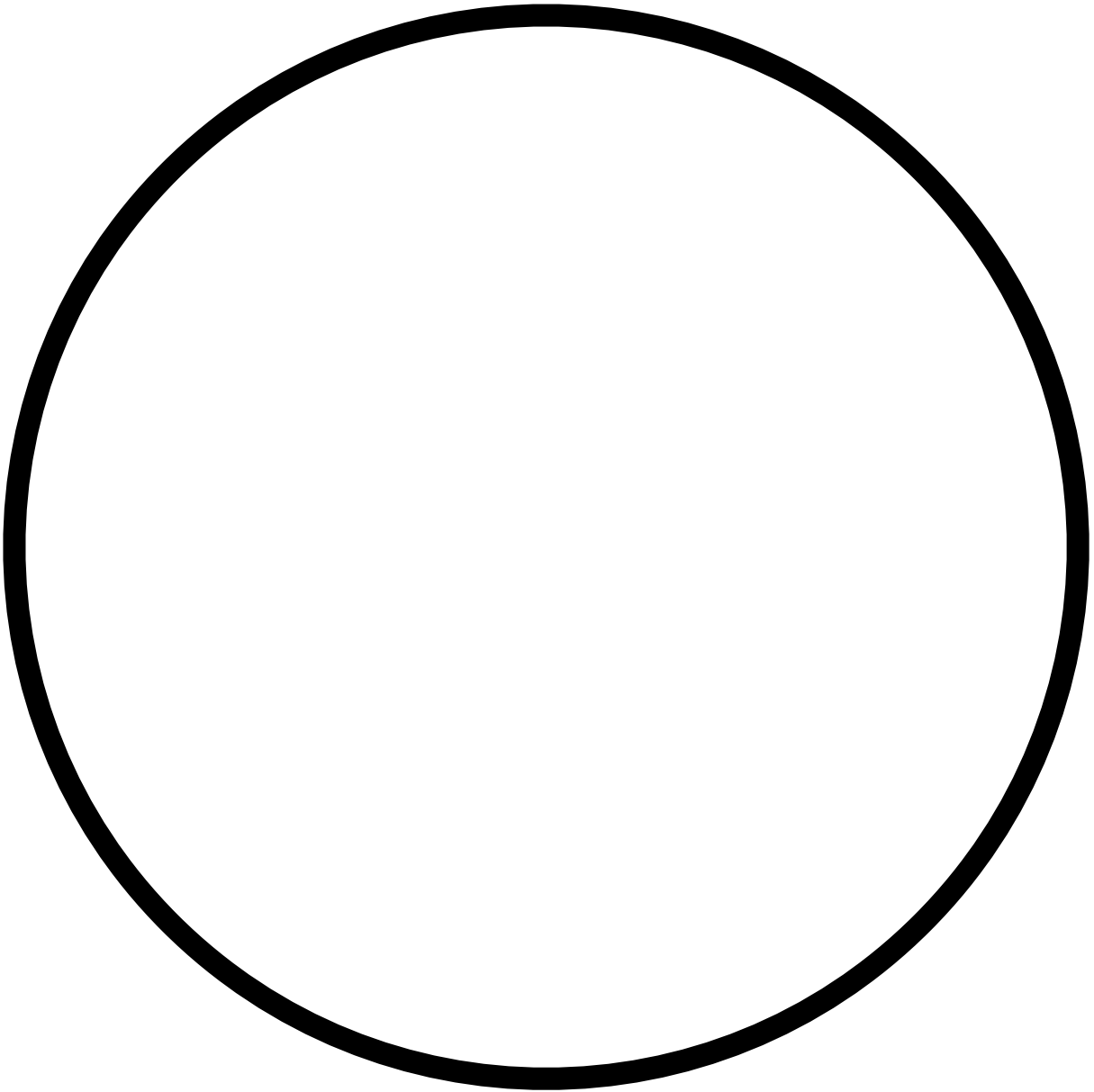
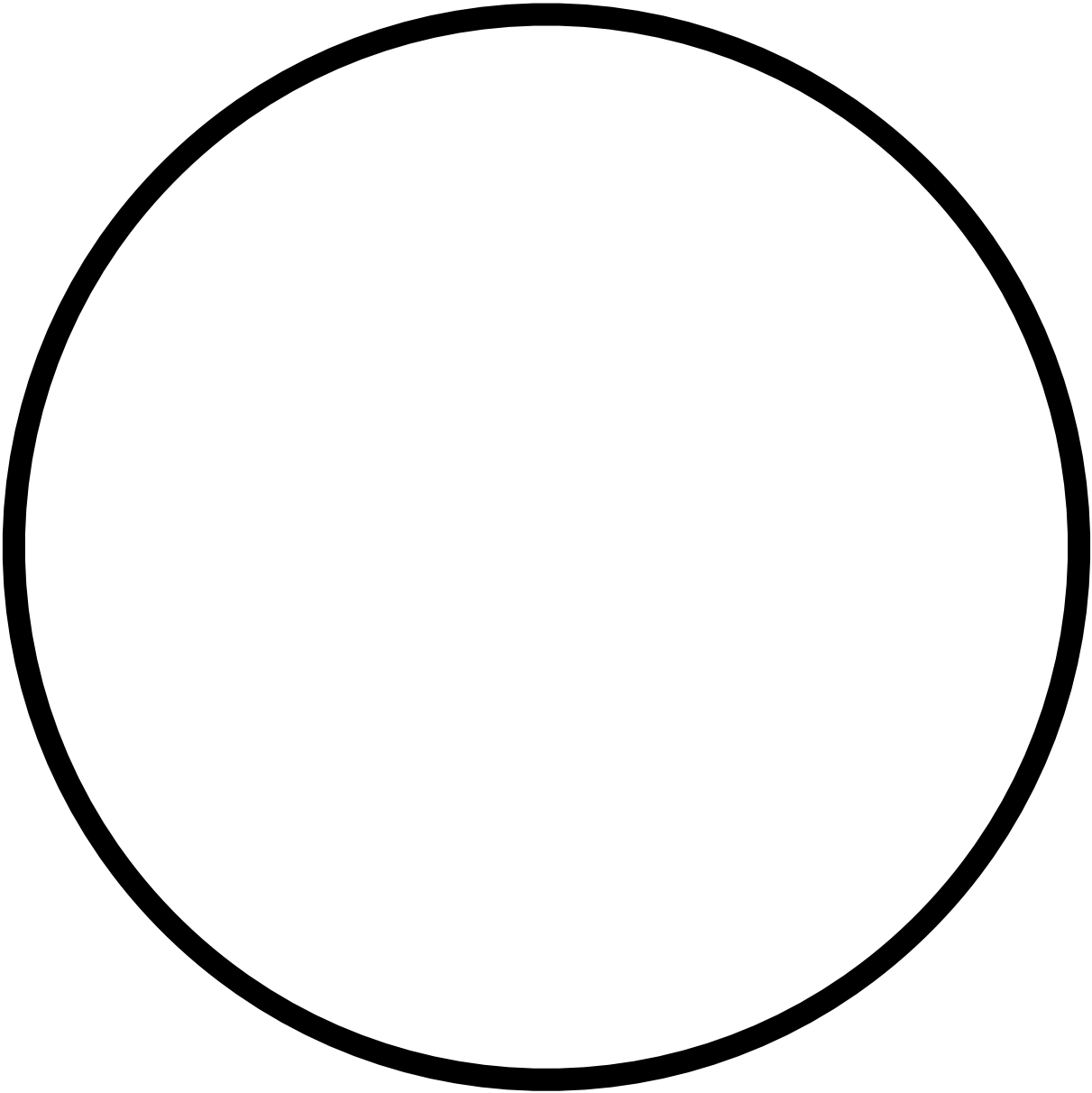
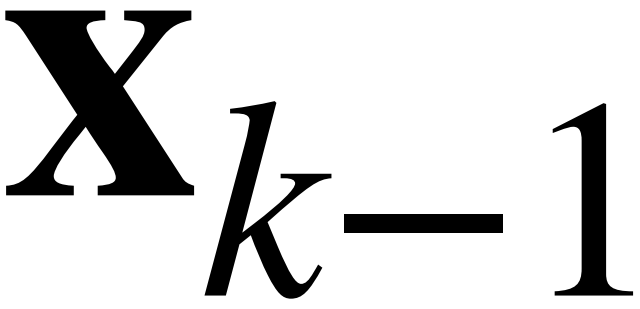
SLIM

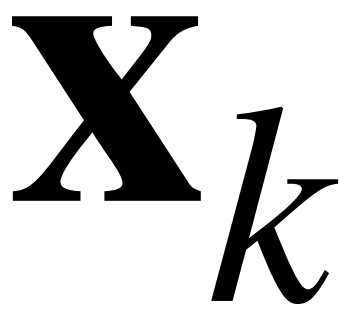
ML4Seismic

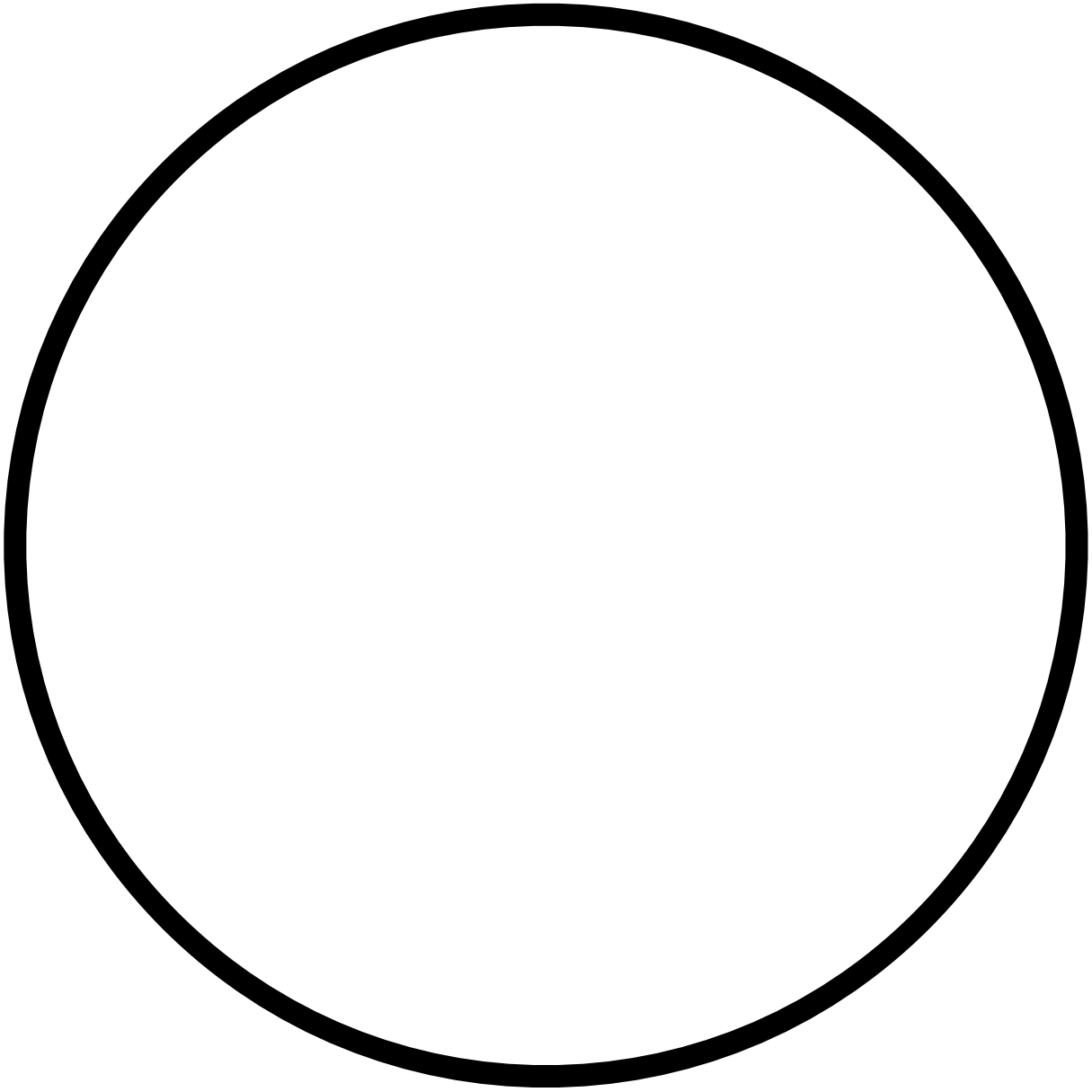
Learned Sequential Bayesian Inference

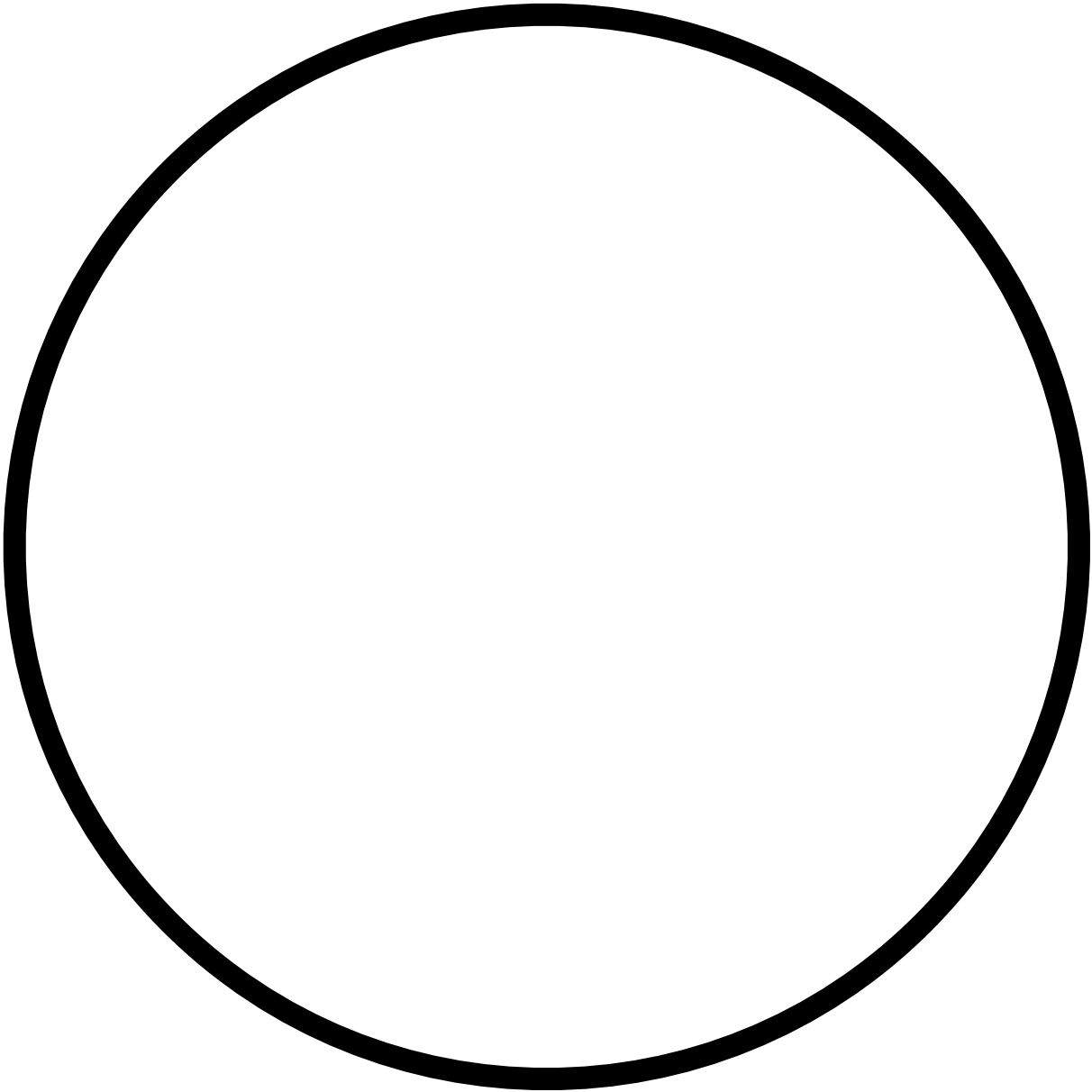


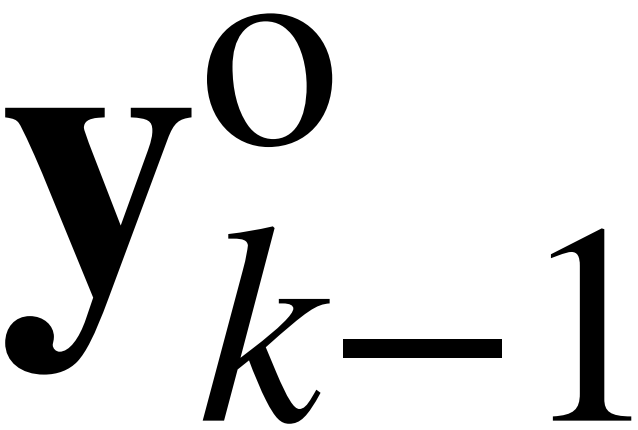


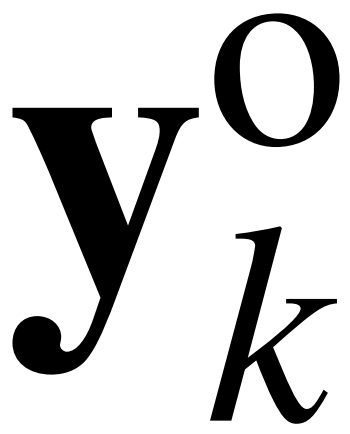








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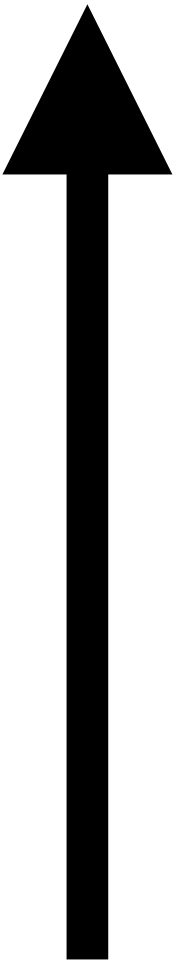

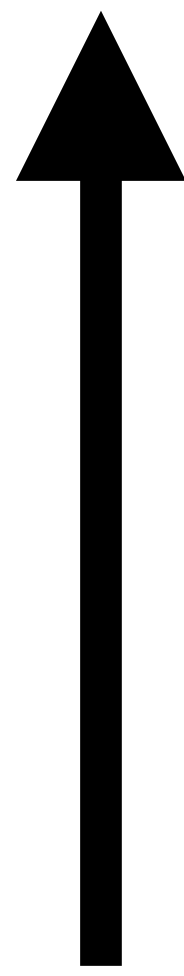

sample from posterior $\mathbf{x}_k \sim p(\mathbf{x}_k \mid \mathbf{y}_k^{\mathrm{o}})$

Note: implicitly sampled from

$$p(\mathbf{x}_k \mid \mathbf{y}_k, \mathbf{y}_{1:k-1}) = \frac{p(\mathbf{y}_k \mid \mathbf{x}_k) p(\mathbf{x}_k \mid \mathbf{y}_{1:k-1})}{p(\mathbf{y}_k \mid \mathbf{y}_{1:k-1})}$$

$$p(\mathbf{x}_k \mid \mathbf{y}_{1:k-1}) = \mathbb{E}_{\mathbf{x}_{k-1} \sim p\left(\mathbf{x}_{k-1} \mid \mathbf{y}_{1:k-1}\right)} \left[p\left(\mathbf{x}_k \mid \mathbf{x}_{k-1}\right) \right]$$

Marginalizes over

- previous state $\mathbf{x}_{k-1}$
- permeability $\mathbf{K}$

Sample from posterior $\mathbf{x}_k \sim p(\mathbf{x}_k \,|\, \mathbf{y}_k^{\mathrm{o}})$ via $\mathbf{x}_k = f_{\hat{\phi}}^{-1}(\mathbf{z}; \mathbf{y}_k^{\mathrm{o}})$ with $\mathbf{z} \sim N(\mathbf{0}, \mathbf{I})$.

$$\mathbf{x}_k \sim p(\mathbf{x}_k \mid \mathbf{y}_k^{\mathrm{o}})$$

HINT: Hierarchical Invertible Neural Transport for General and Sequential Bayesian inference, Detommaso, et. al., arXiv:1905.10687

Learned Sequential Bayesian Inference

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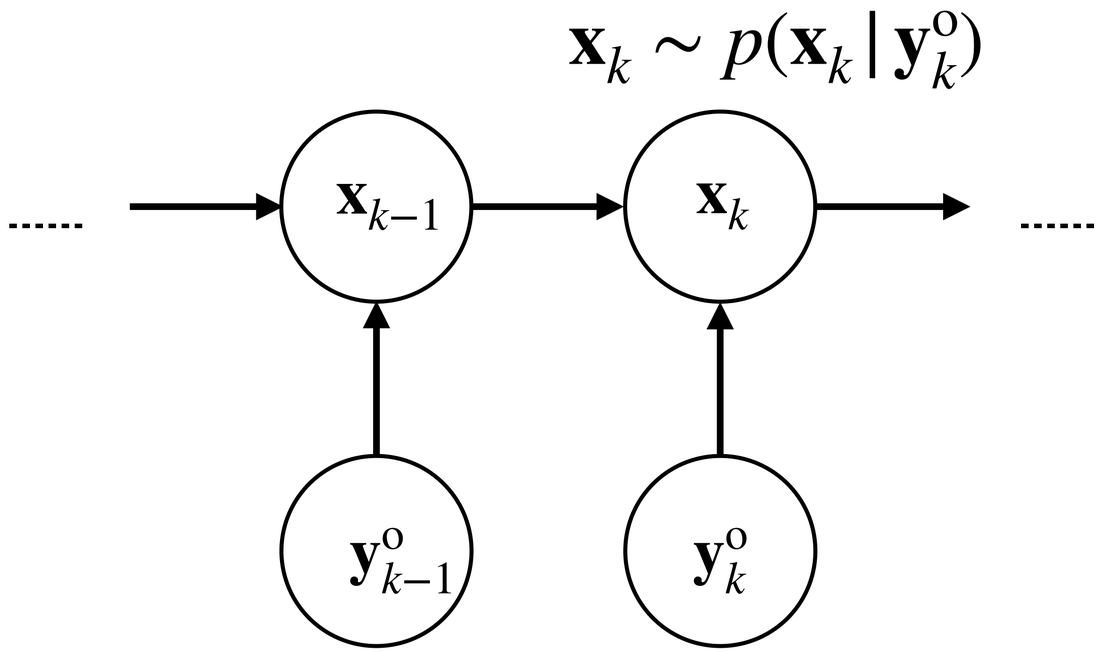

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Physical simulations