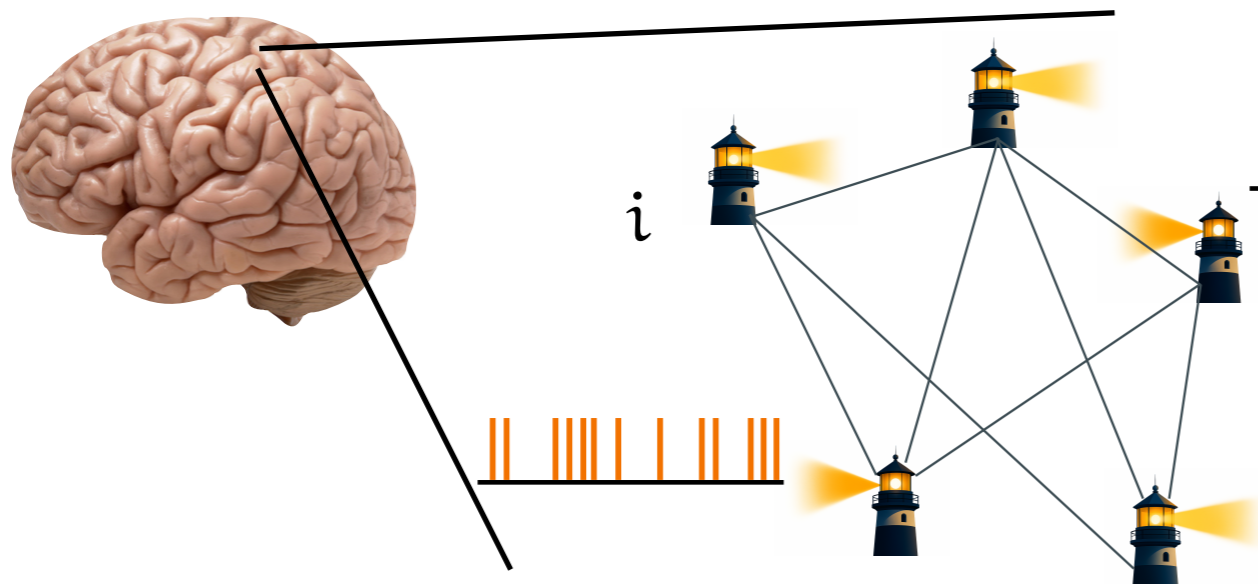
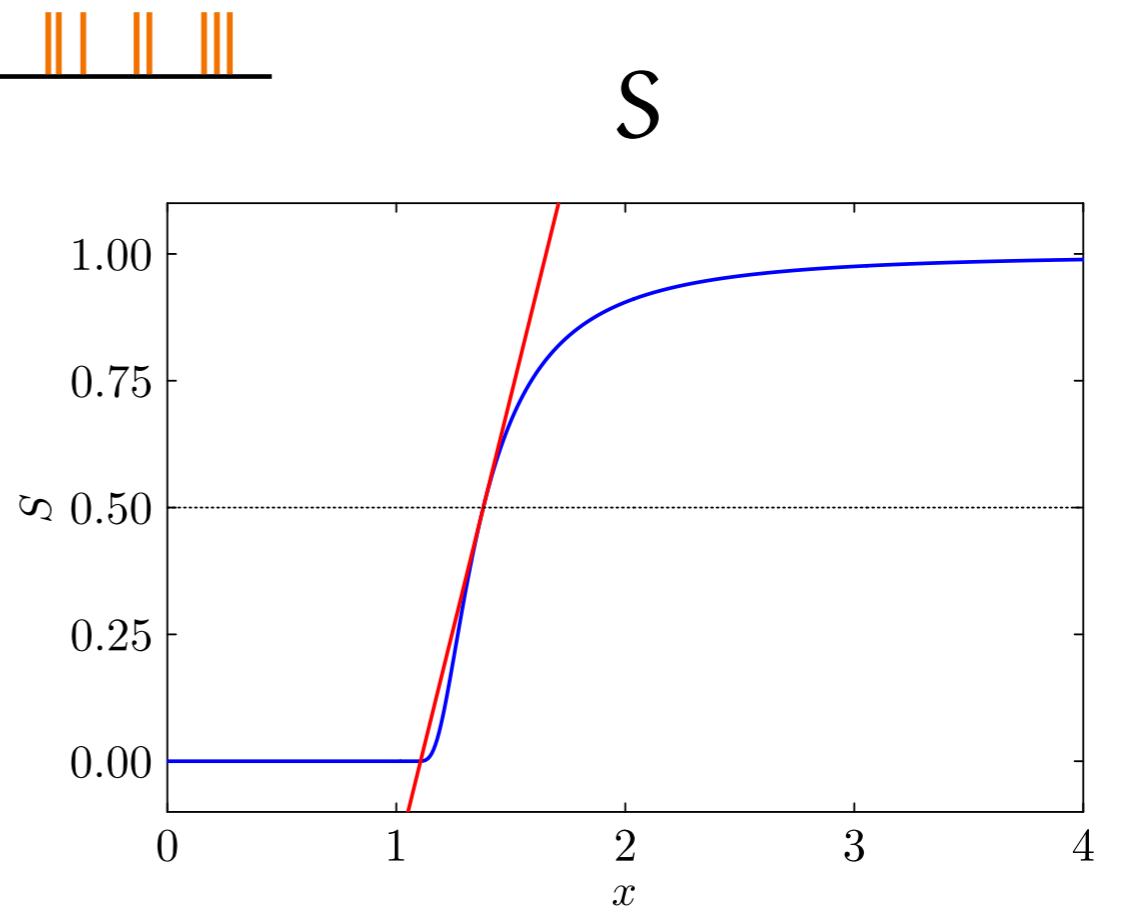


# The Lighthouse network model



$i = 1, \dots, N$



Drive

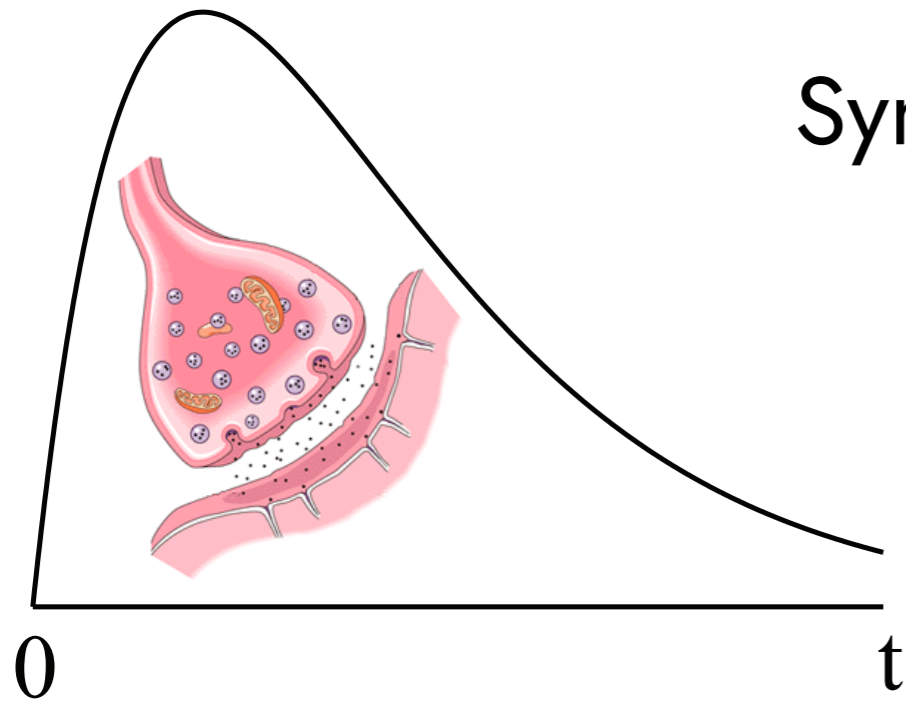
$$\frac{d}{dt} \theta_i = S(\psi_i)$$

Spike emitted when

$$\theta_i = 2\pi$$

... or your favourite sigmoid, ReLu, ... function

# Synaptic interactions and axonal delays



Synapse model  $\eta(t) = \alpha^2 t e^{-\alpha t}$

$$Q\eta = \delta \quad Q = \left(1 + \frac{1}{\alpha} \frac{d}{dt}\right)^2$$

axonal delays

$$\psi_i(t) = \sum_{j=1}^N w_{ij} s_j(t - \tau_{ij})$$

synaptic weights

$$s_i(t) = \sum_{m \in \mathbb{Z}} \eta(t - T_i^m)$$

Spike times

$$\theta_i(T_i^m) = 2\pi m$$

Similar to many other SNNs – just a different spiking mechanism

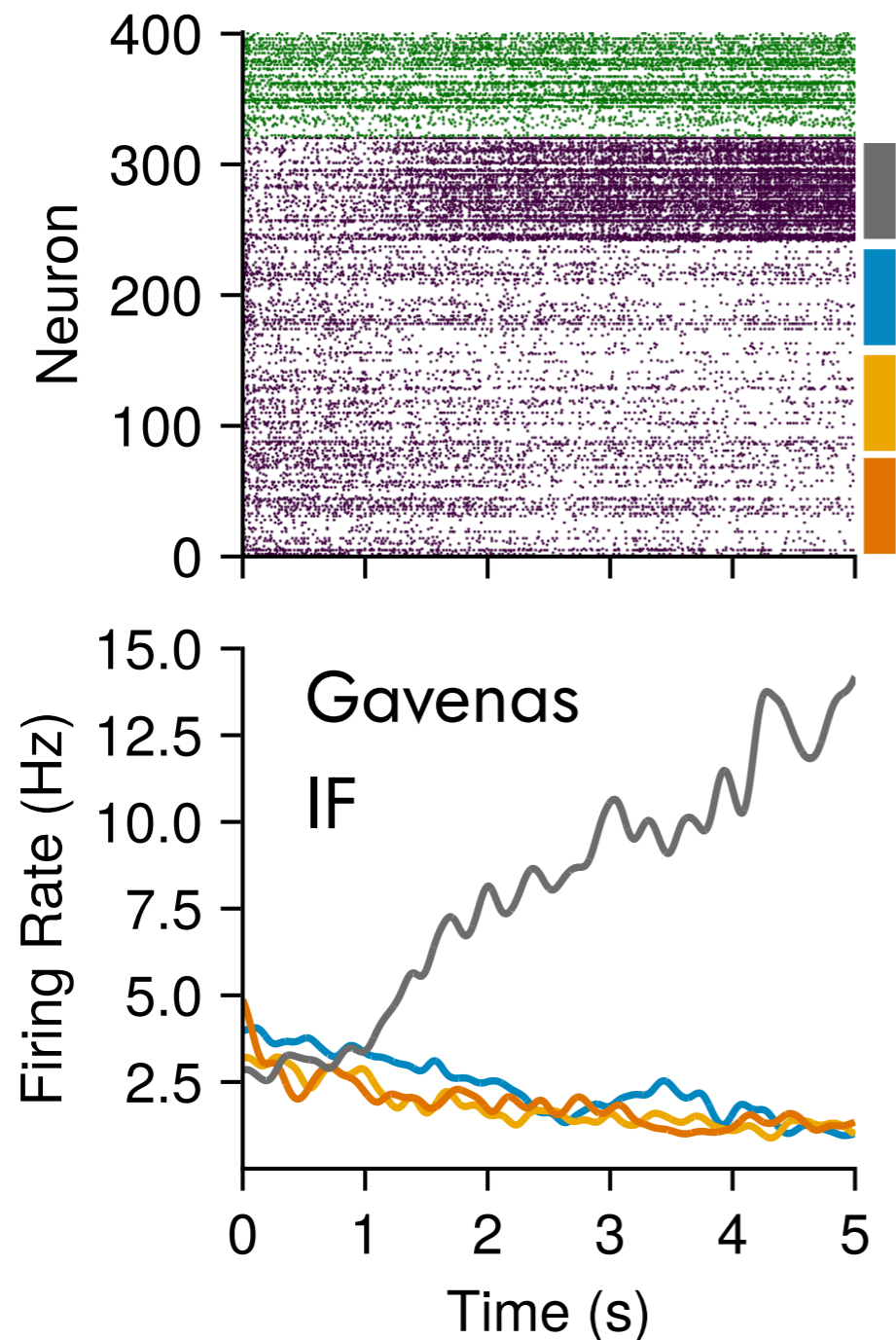


# Slow ramping emerges from spontaneous fluctuations in spiking neural networks

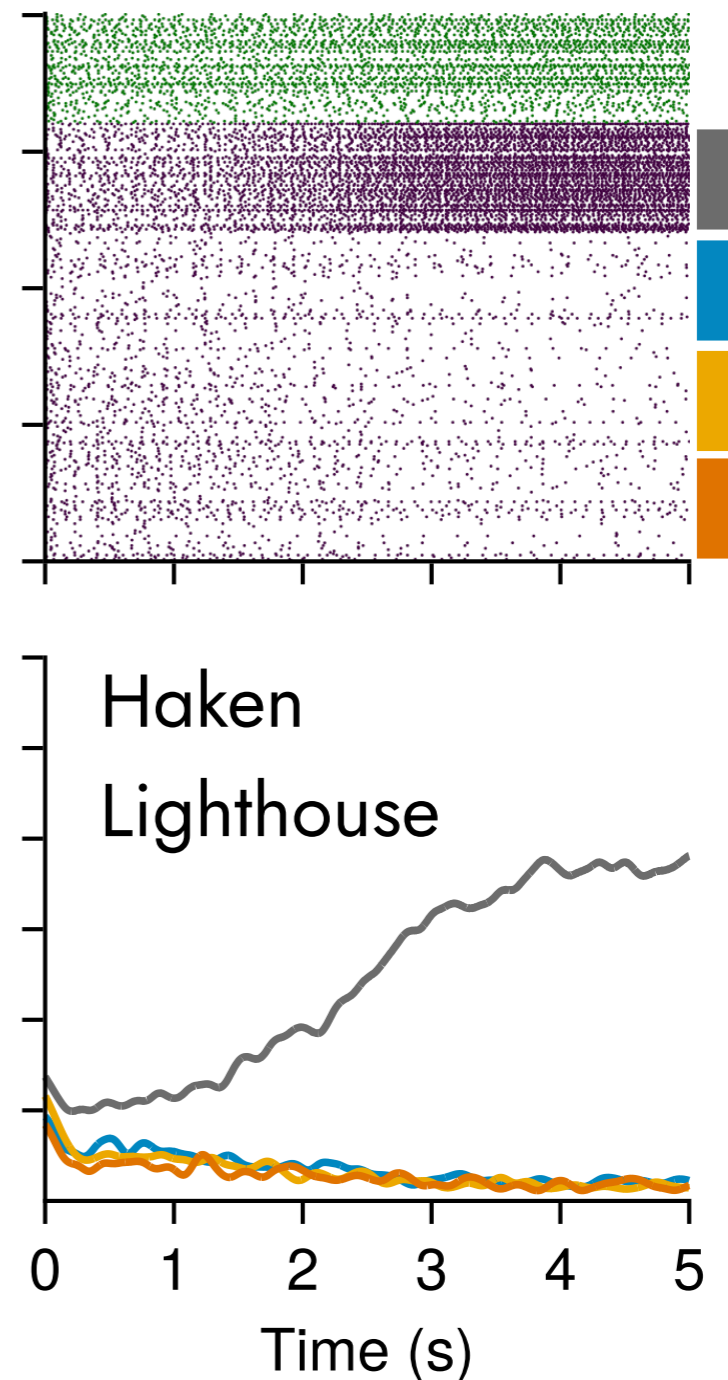
Received: 13 October 2023

Jake Gavenas<sup>1,2,3</sup>✉, Ueli Rutishauser<sup>3,4,5,6</sup>, Aaron Schurger<sup>1,7,8,9</sup> & Uri Maoz<sup>1,2,6,7,10,11</sup>✉

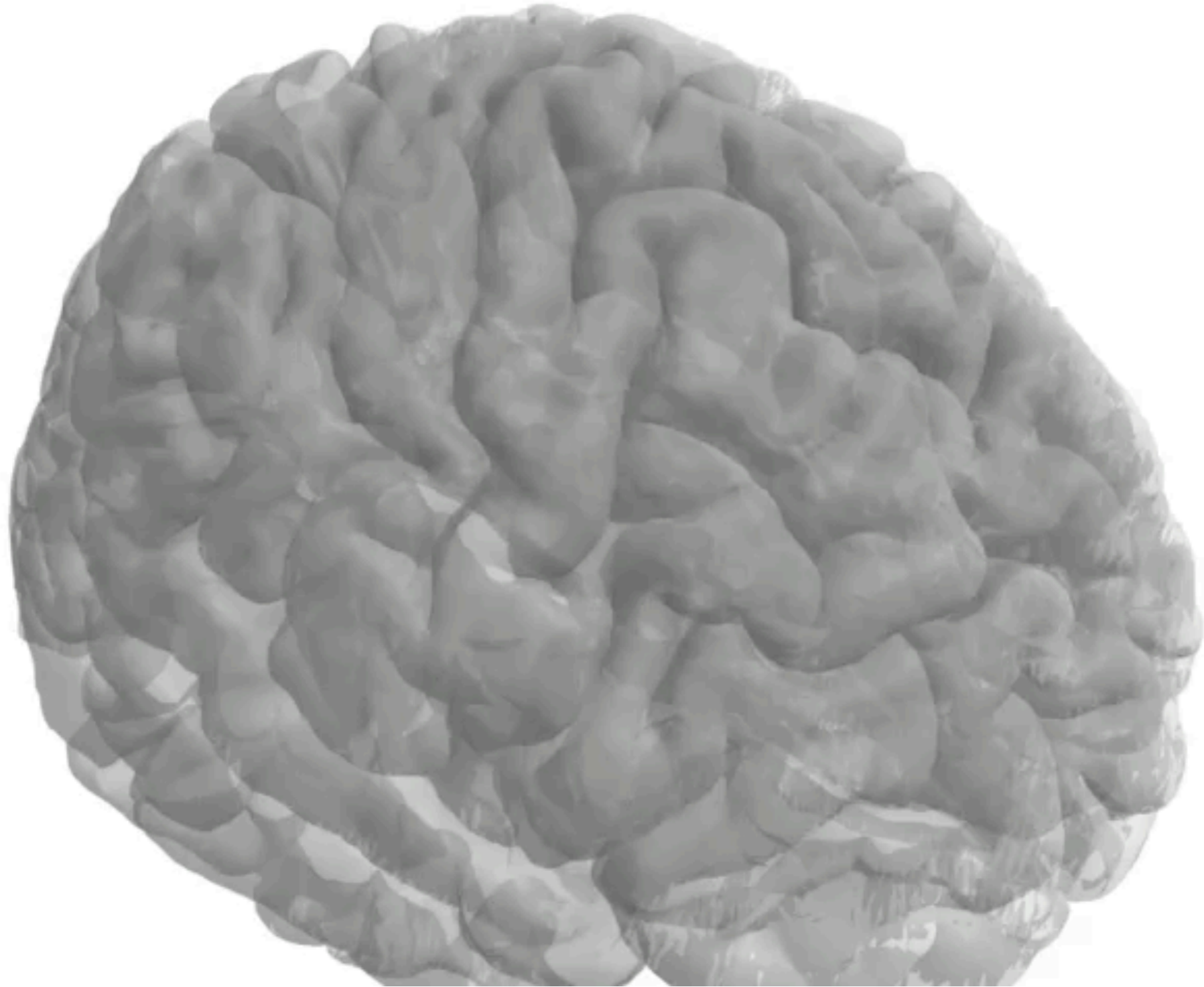
Accepted: 5 August 2024



Slow ramping activity is observed in medial frontal cortex before spontaneous voluntary movements.



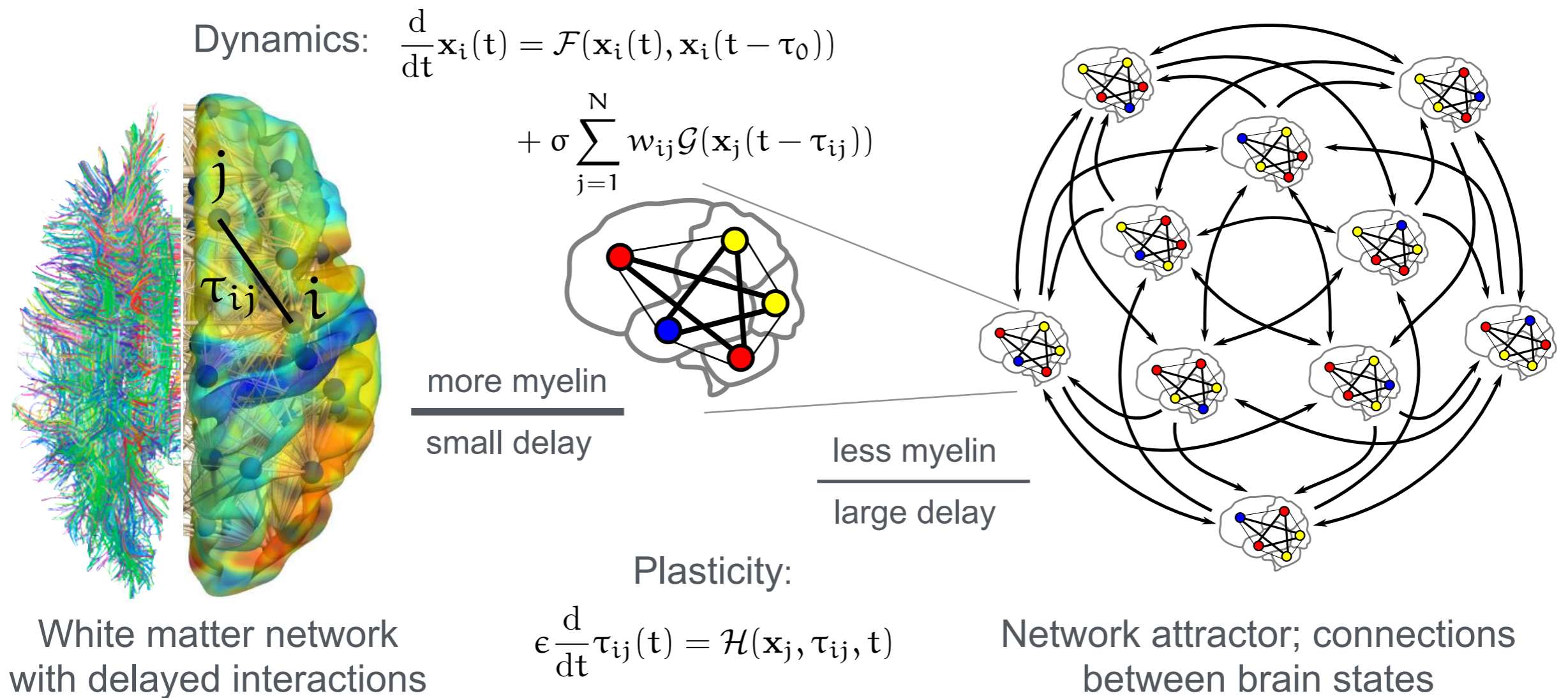
Computationally cheap



Analytically tractable

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## White Matter Computation: Utilising axonal delays to sculpt network attractors



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