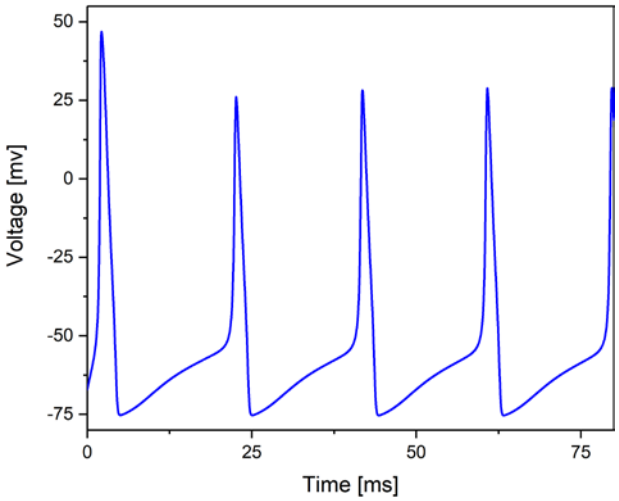
H-H model



$$C_m \frac{dV}{dt} = -\bar{g}_{Na} m^3 h (V - V_{Na}) - \bar{g}_K n^4 (V - V_K) - g_L (V - V_L)$$

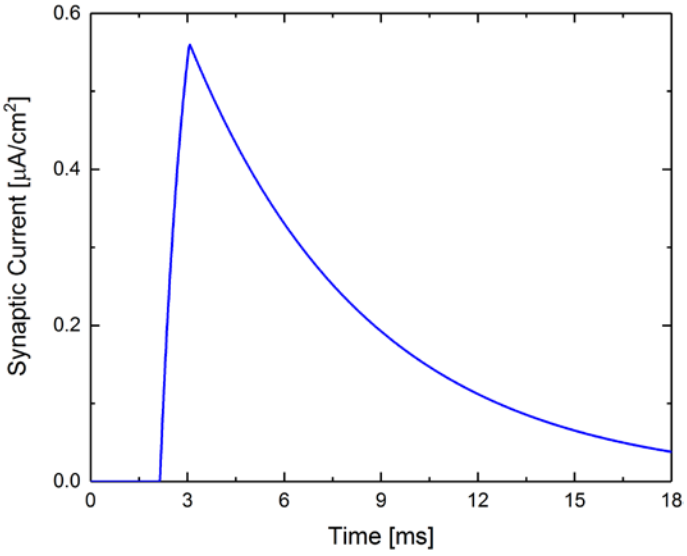
$$\frac{dm}{dt} = \alpha_m(v)(1-m) - \beta_m(v)m$$

$$\frac{dn}{dt} = \alpha_n(v)(1-n) - \beta_n(v)n$$

$$\frac{dh}{dt} = \alpha_h(v)(1-h) - \beta_h(v)h$$

Synapse Dynamic

$$C_m \frac{dV}{dt} = -\bar{g}_{Na} m^3 h (V - V_{Na}) - \bar{g}_K n^4 (V - V_K) - g_L (V - V_L) + I_{app} - I_{Syn}$$



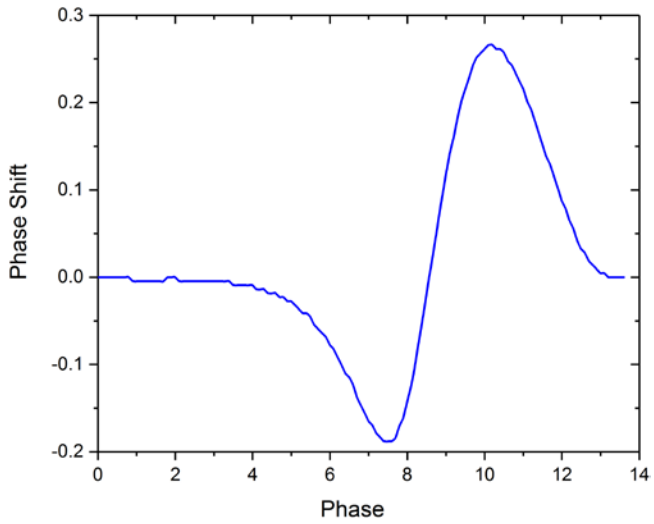
$$I_{Syn} = S\, g_{syn}\, (V_{post} - E_{Syn})$$

$$dS/dt = \alpha\,(V_{pre})(1 - S) - \beta S$$

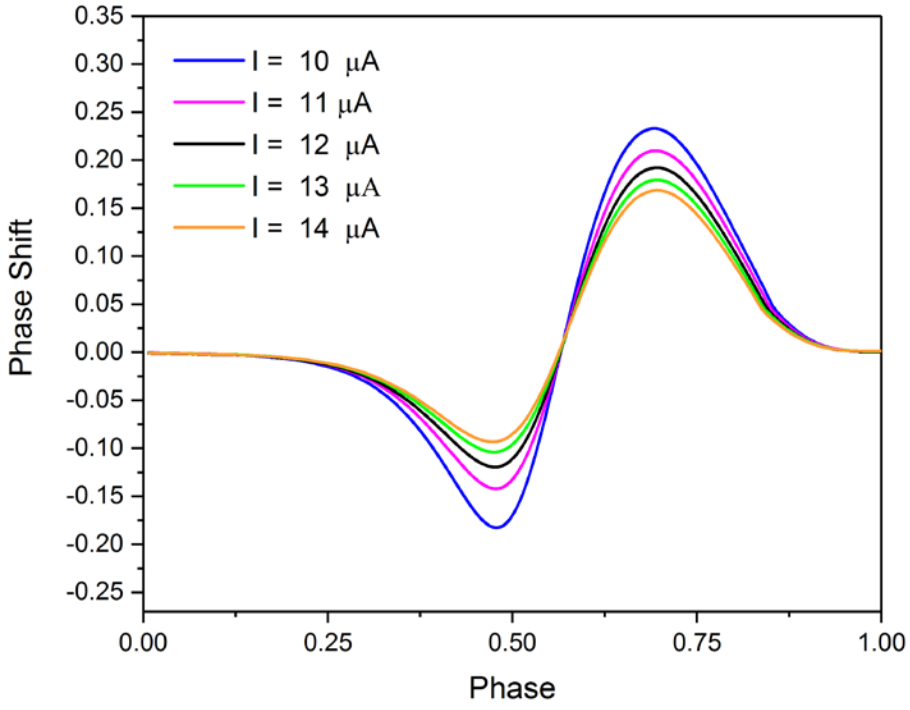
close $\xrightarrow{\alpha}$ open

open $\xrightarrow{\beta}$ close

PRC of single neuron (H-H model) - Type2

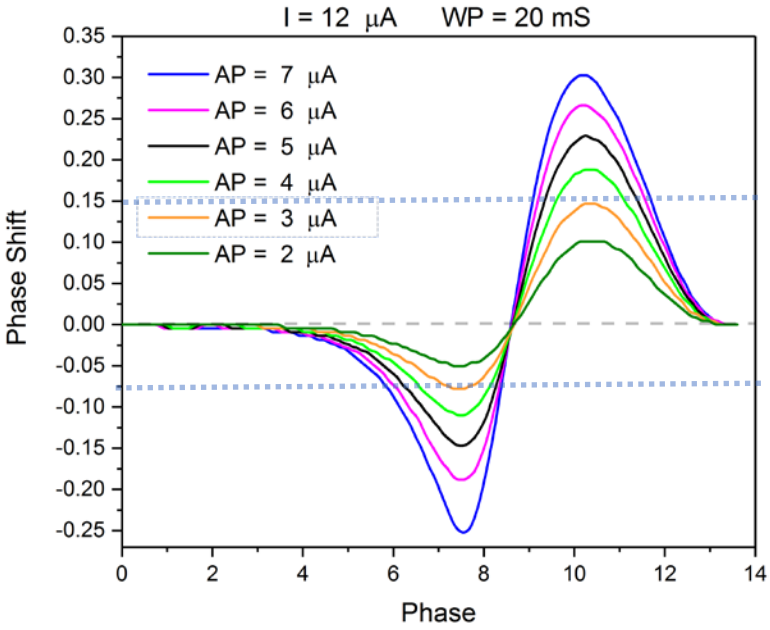


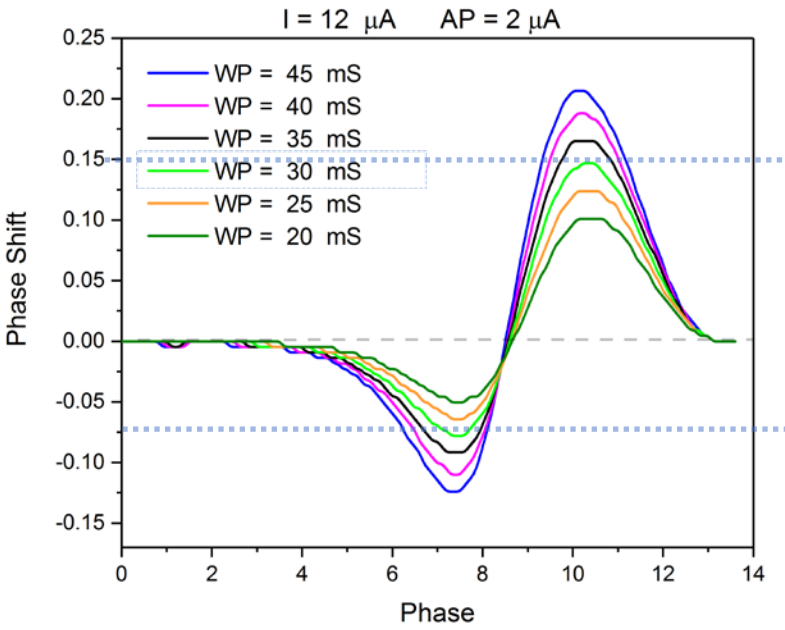
PRC of single neuron by changing the Injected current



Comparing the change of amplitude and width pulse of perturbation on PRC

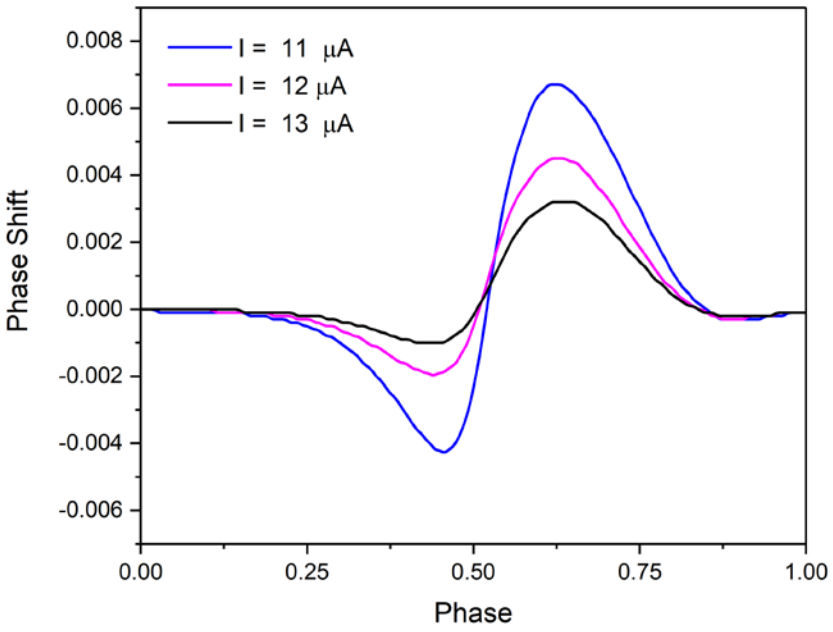
AP= Amplitude of pulse **WP**= Width of pulse

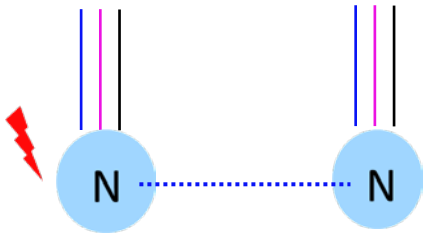


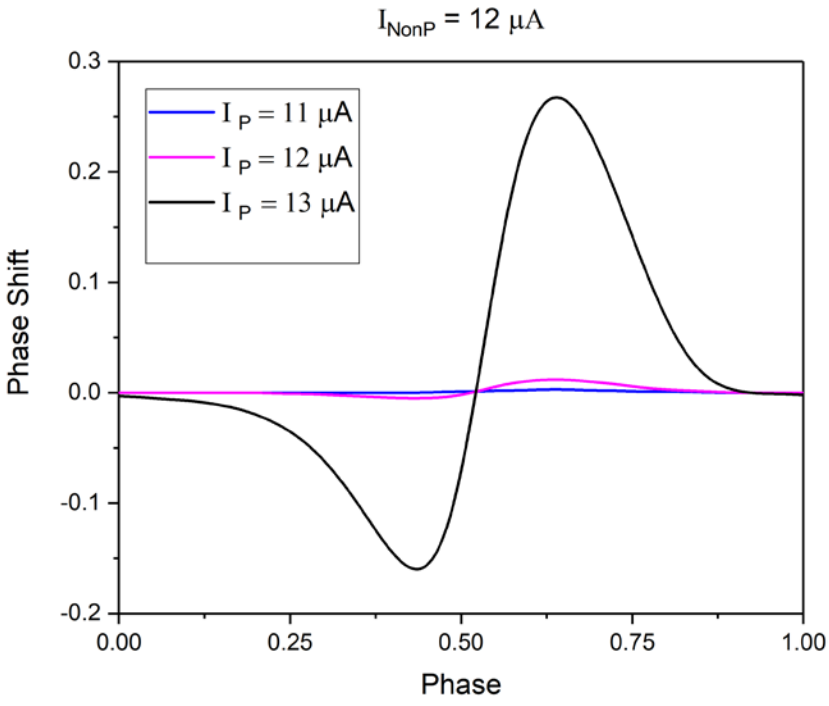


PRC of two homogeneous coupled neurons:

The phase response of a neuron to induced perturbation on the other neuron in homogenous state and by changing currents.





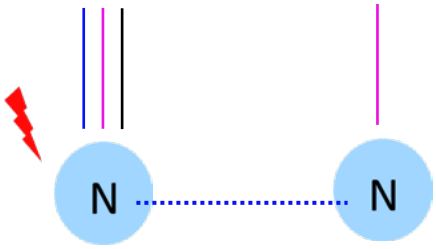


PRC of two inhomogeneous coupled neurons:

The phase response of a neuron to induced perturbation on the other neuron in inhomogeneous state and by changing currents.

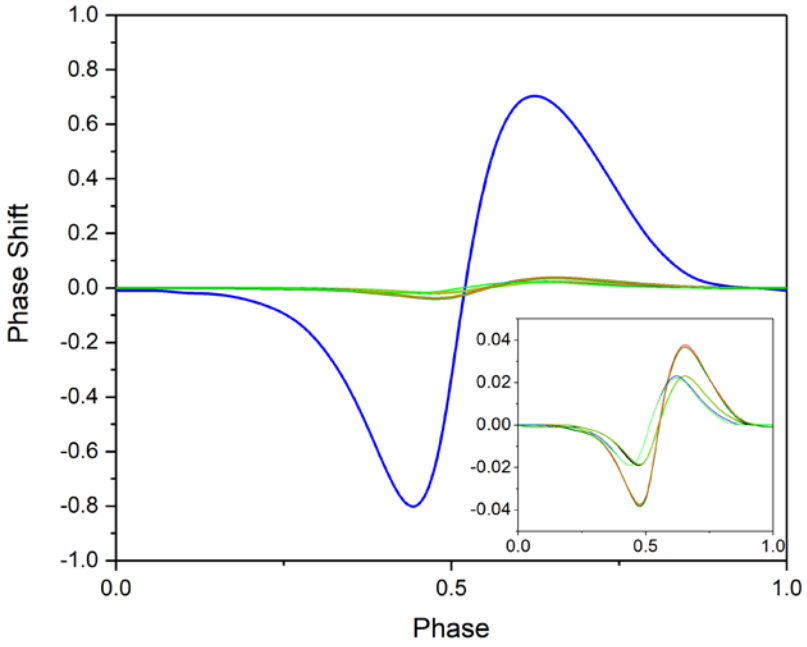
$\boldsymbol{I_{NonP}}$= Injected current of non-perturbed neuron

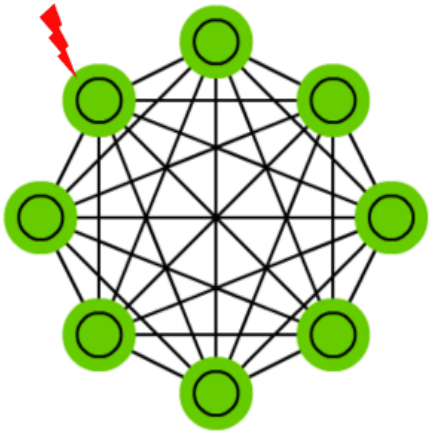
$\boldsymbol{I_P}$= Injected current of perturbed neuron



PRC of homogenous Network

The phase response of neural network to induced perturbation on one neuron in homogenous state.





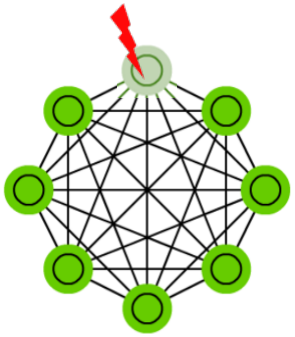
A_{pert} =2 μA/cm^2

W_{pert} =200 ms

g = 0.04 mS/cm^2

PRC of inomogeneous Network

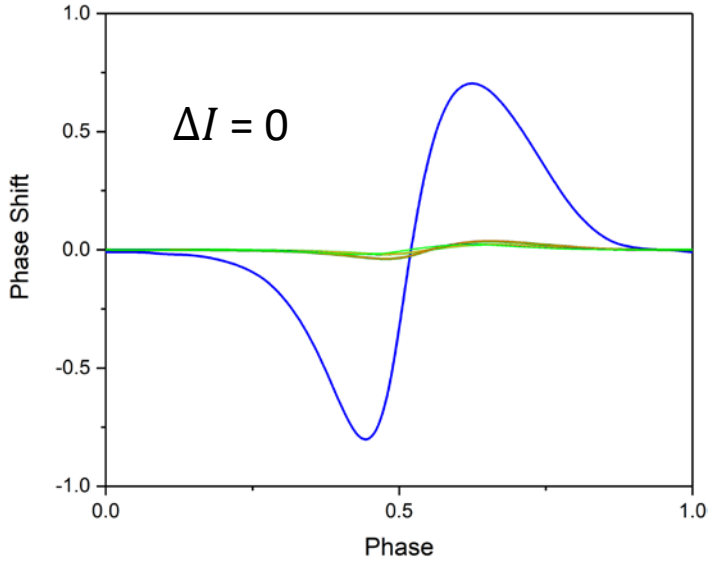
The phase response of network to induced perturbation on one neuron in homogenous state.

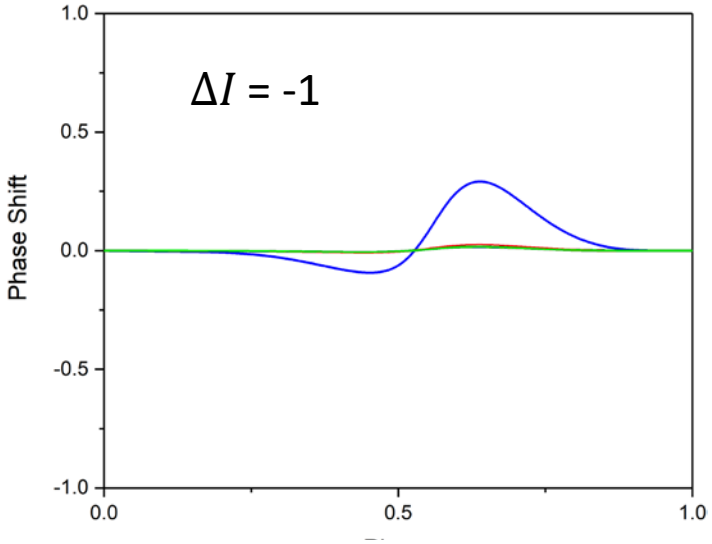


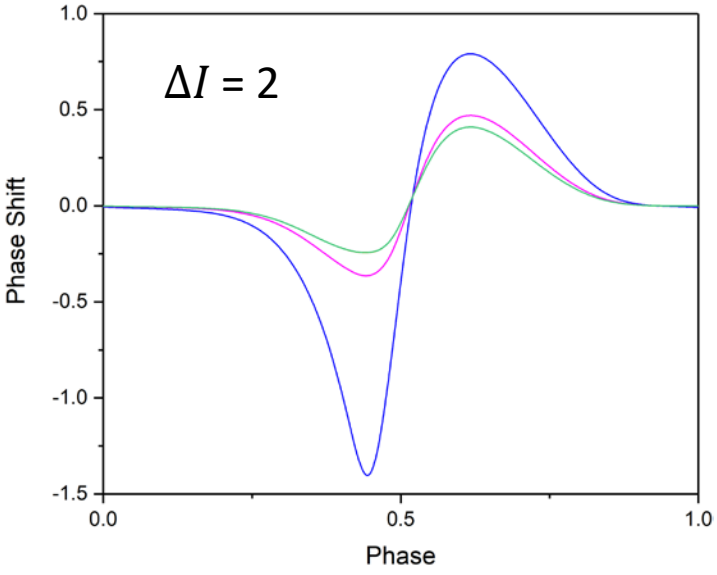
Dark green: Unperturbed neuron

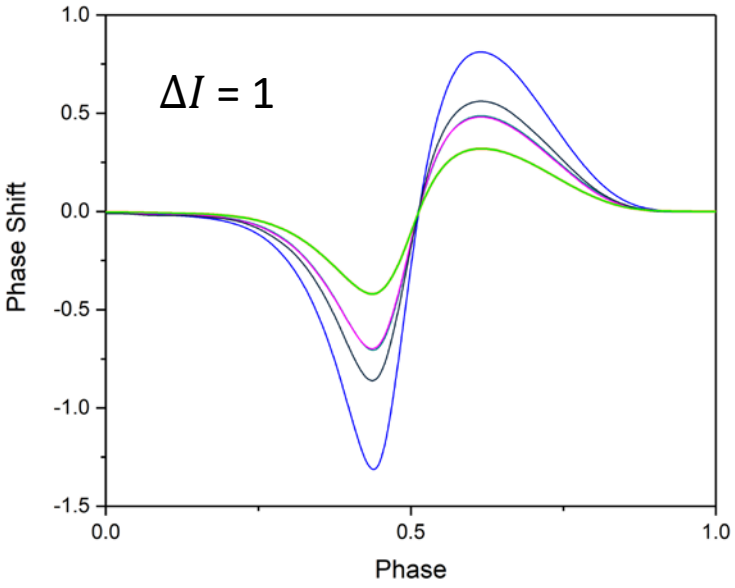
Light green: Perturbated neuron

$$\Delta \mathbf{I} = I_{\text{pert. N}} - I_{\text{General}}$$

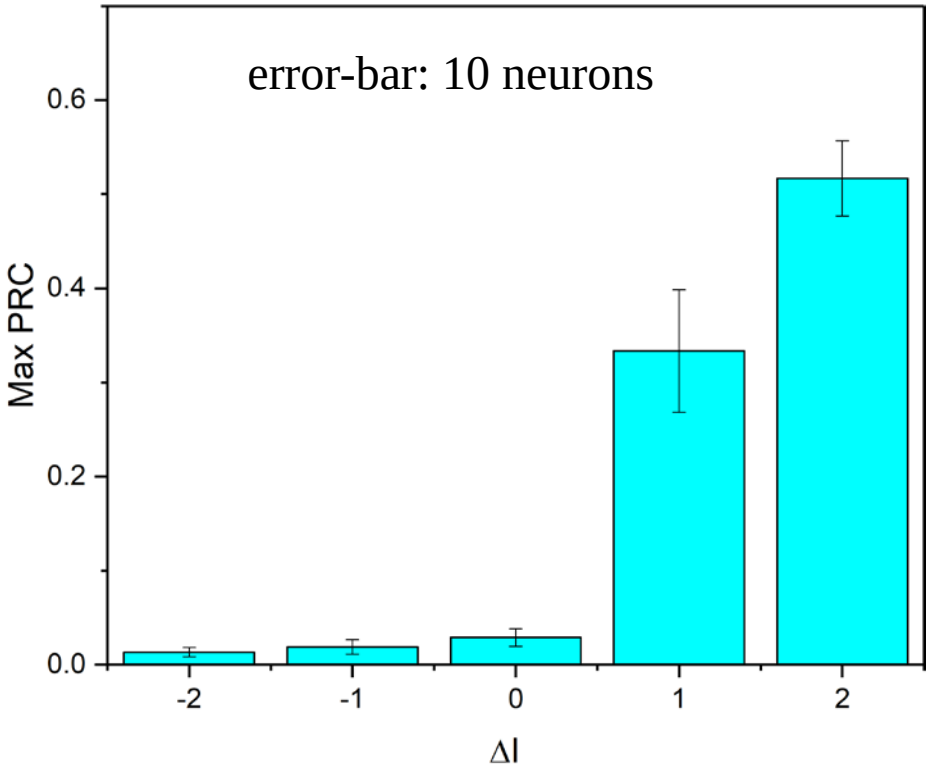


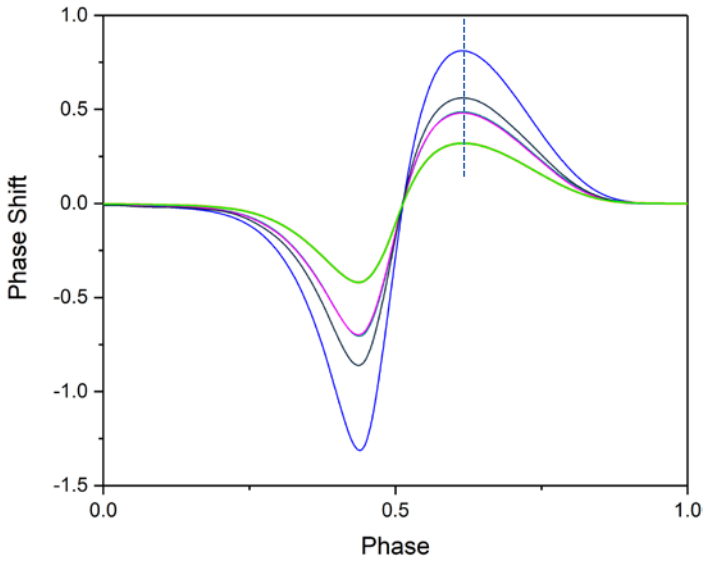






Max of PRC


error-bar: 10 neurons
Max PRC
0.0
0.2
0.4
0.6
-2
-1
0
1
2
ΔI


Phase Shift
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.0
0.5
1.0
Phase