RUB

SFB 874/INI - COLLOQUIUM

Wednesday, 7th of August, 12 pm Venue: NB 3/57

The benefit of phase precession for sequence learning

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Abstract:

The temporal organization of events is a defining feature of episodic memory but the neuronal mechanism underlying sequence learning are not understood. A successful encoding of sequences - possibly initially in the hippocampal formation - requires synaptic plasticity rules that are matched to the timing of neuronal activity. However, the time scales for the induction of synaptic plasticity are typically on the order of milliseconds whereas sequences of behavioral events are much slower. The connection between the different time scales could be mediated by phase precession, which has since long been hypothesized to allow for a temporal compression of behavioral sequences. Such a temporal compression would support spike-timing dependent synaptic plasticity (STDP) rules, which are sensitive to the temporal order of spikes, However, the potential benefit of phase precession for sequence learning has never been quantified. Using analytical calculations and simulations, here we show that phase precession facilitates sequence learning tremendously, and that the experimentally observed slope of phase precession is close the theoretical optimum. Furthermore, we find that the asymmetric part of the STDP learning window is essential for sequence learning. We predict that manipulations of the symmetry of the STDP learning window or the strength of phase precession interfere with sequence learning.

Host: Prof. Dr. Sen Cheng, Eloy Parra Barrero



