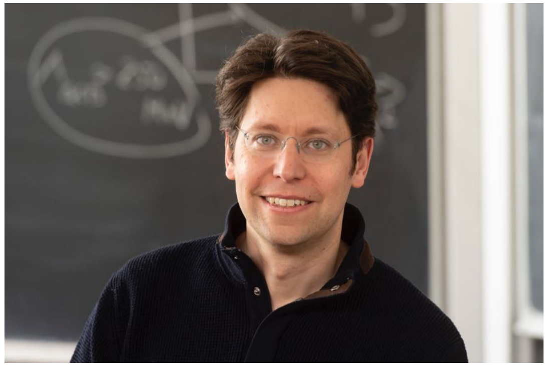
Fachgruppe
Physik und Astronomie
Universität Bonn

Physikalisches Kolloquium

Fachgruppe Physik/Astronomie der Universität Bonn

UNIVERSITÄT BONN

Freitag, 13. Mai 2022, 15 Uhr c.t. im Hörsaal I des Physikalischen Instituts

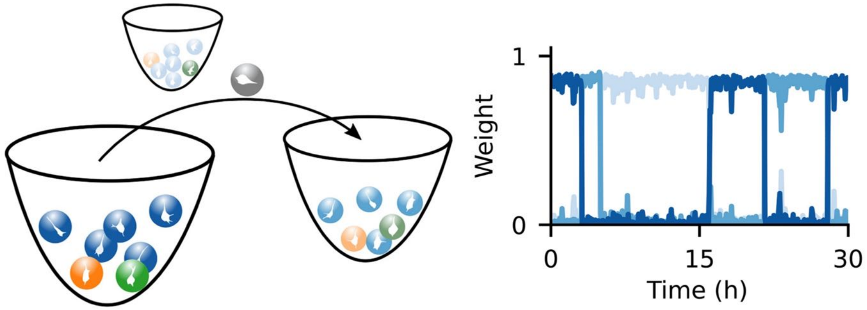


Raoul-Martin Memmesheimer

Universität Bonn

„Drift of neuronal network clusters as random walks between emergent metastable states“

In standard neuronal network models, memories are represented by assemblies, clusters of strongly interconnected neurons. We propose that these assemblies are not static but drift freely in neural circuits. This explains experimental findings of changing memory representations and network connectivity. On the level of single neurons, assembly drift is reflected by characteristic dynamics: relatively long times of stable assembly membership interspersed with fast transitions. How can we mechanistically understand these dynamics? We answer this question by proposing simplified, reduced models. We first construct a random walk model for neuron transitions between assemblies based on the statistics of synaptic weight changes measured in simulations of neural networks exhibiting assembly drift. It shows that neuron transitions between assemblies can be understood as noise-activated switching between metastable states. The random walk's potential landscape and inhomogeneous noise strength induce metastability and thus support assembly maintenance in the presence of ongoing fluctuations. In a second step, we derive an effective random walk model from first principles. The approaches can be applied generally to neural networks with drifting clusters, irrespective of the employed neuron and synapse models.



Es gelten die Corona-Regelungen des Landes Nordrhein-Westfalen