

[Talk 26] Ergodicity breaking on the neuronal surface

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Tracking individual proteins on the surface of hippocampal neurons reveals complex dynamics involving anomalous diffusion and clustering into nanoscale domains. Theoretical models show that anomalous subdiffusion can be caused by different processes. By means of the dynamical functional, i.e., the time-averaged characteristic function of the increments, we show that most trajectories are non-ergodic. Furthermore, the time-averaged mean square displacements (MSD) are different from the ensemble-averaged MSD. We find that ergodicity breaking is caused by the random switching between a cluster-confined state and a free state. When the parts of the trajectories exhibiting confined motion are artificially removed from the data, the trajectories become ergodic according to the dynamical functional test, and the EA-MSD cannot be differentiated from the TA-MSD. Our data also show that the random walks display aging, i.e., the MSD depends on the time that passed since the initial state, and that when the particles are in the free state they exhibit anticorrelated subdiffusion.