

Nicolas BRUNEL

Lundi 20 juin 2005
Conférence Systèmes Dynamiques

15h00 – 15h45

Spatiotemporal dynamics of networks with spatially decaying connectivity

Electrophysiological and anatomical data provide detailed information about the spatial and functional organization of cerebral cortex. Cortical patterns of connectivity influence the intrinsic dynamics of cortical circuits which can now be visualized using optical techniques. The relationship between the spatial profile of neural interactions and spatio-temporal patterns of neuronal activity can be investigated using modeling studies. Here, I will present recent theoretical results on the spatio-temporal dynamics of large networks of neurons with delayed synaptic communication and spatially decaying connectivity. Such networks exhibit a rich phase diagram, which includes oscillatory bumps, traveling waves, lurching waves, standing waves arising via a period doubling bifurcation, aperiodic regimes and regimes of multistability.

We have studied the existence and the stability of the various dynamical patterns analytically and numerically in a simplified rate model as a function of the interaction parameters. The results derived in that framework allow us to understand the origin of the diversity of dynamical states observed in large networks of spiking neurons.

Finally, I will discuss the physiological and functional significance of these results.

Nicolas BRUNEL

Laboratory of Neurophysics and Physiology
UMR 8119 CNRS-Université René Descartes
45 rue des Saints Pères 75270 Paris Cedex 06
Tel (33).1.42.86.20.58 - Fax (33).1.49.27.90.62
nicolas.brunel@univ-paris5.fr
www.neurophys.biomedicale.univ-paris5.fr/~brunel