Berlin Center for Studies of Complex Chemical Systems

**Fritz Haber Institute of the Max Planck Society, Technical University of Berlin,
Max Delbrueck Centre for Molecular Medicine, Otto von Guericke University of Magdeburg,
Physikalisch-Technische Bundesanstalt**

Seminar "Complex Nonlinear Processes in Chemistry and Biology"

Honorary Chairman: Gerhard Ertl
Organizers: M. Bär, H. Engel, M. Falcke, M. Hauser, A. S. Mikhailov, P. Plath, H. Stark

Friday, 2 July 2010, 16:00 *s.t.*

Hiroshi Kori (Division of Advanced Sciences, Ochamizu University, Tokyo)

"Network structure determines the intensity of collective fluctuations in systems of coupled noisy oscillators"

Abstract:

Collective dynamics result from interactions among noisy dynamical components. Examples include heartbeats, circadian rhythms, and various pattern formations. Because of noise in each component, collective dynamics inevitably involve fluctuations, which may crucially affect functioning of the system. However, the relation between the fluctuations in isolated individual components and those in collective dynamics is unclear. Here we study networks of phase oscillators subjected to independent Gaussian noise and analytically show that the connectivity of networks determines the intensity of fluctuations in the collective dynamics. Remarkably, in general directed networks including scale-free networks, the fluctuations decrease more slowly with the system size than the standard law stated by the central limit theorem. They even remain finite for a large system size when global directionality of the network exists. Implications of our results in biological rhythms such as heartbeats and the circadian clock are discussed.

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