



EINLADUNG

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ZIH-Kolloquium

Titel: Electrical Noise and Fractals in Cells, Membranes and Neurons

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Abstract:

Fluctuation analysis has been an important aspect of research in various disciplines e.g. physics, chemistry, geology, environmental sciences, biology and others. The fluctuation in a system is either the noise created by external forces or due to the internal dynamics. Interestingly, many of these systems exhibit $1/f$ power spectrum despite large differences in their basic properties. In physiology, a good number of reports related to noise have come up during recent years. Advanced electrophysiological experiments, as reported earlier, enable us to record currents through a single or a group of channels on a cell or a lipid bilayer membrane under voltage clamped conditions. We discuss the time series behaviour of the channel currents and the associated noise.

The role of noise in a living system is not very well understood. Nevertheless, the quantification of noise at the ion channel level has thrown light on the phenomenon of transport of ions and metabolites across cell membrane and its mechanisms. Power Spectrum analysis of current indicates powerlaw noise of $1/f$ nature. We discuss the origin of $1/f$ noise in open ion channels. The process is recognized as a phenomenon of self-organized-criticality (SOC) like sandpile avalanche and other physical systems. For multi-channels, Power Spectral Density, we found, is a good parameter to probe collective behavior of ion channels.

Neuronal communications and transfer of action potential in neurons through synapses has been recognized to be the key parameter for functioning of the brain. We demonstrate through a computational approach that synaptic noise, a kind of channel noise, enables weak input signals in the neurons to evoke electrical spikes, and thus plays an important role in the process of brain functioning.

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Zeit: Mittwoch, 3. Juni 2009, 14:00 Uhr

gez. Prof. Dr. Wolfgang E. Nagel