

## **DAAD program RISE 2008**

### **Physics: Control of Neural Dynamics**

Applicant:  
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The activities of our group are centered around theoretical investigations and computer simulations of nonlinear dynamical systems. We deal with self-organized spatio-temporal patterns, control by time-delayed feedback, as well as with the influence of noise.

The network of neurons in the brain exhibits a subtle balance of dynamic chaos and selforganized order in the presence of random fluctuations. A number of neurological diseases like Parkinson’s or epilepsy are characterized by a disturbance of this balance, e.g. synchronized firing of electrical pulses of the neurons. Modern concepts of time-delayed feedback control have recently been applied to suppress this undesired synchrony. By application of time-delayed feedback, which was originally proposed for deterministic chaos control, we influence the cooperative dynamics of neural populations.

With our long-standing experience in the field of dynamical systems and chaos control as well as with computer experiments on noise-induced dynamics we are offering a project which combines both aspects. The candidate will first get an introduction to nonlinear dynamics and bifurcations. Later on, the candidate is asked to perform simulations on neural systems. The data analysis will support the investigations of various coupling scenarios and feedback realizations. Thus, the task is embedded in current scientific projects carried out in our group.

The work will be performed in the group of Prof. Schöll which is located in the Institute for Theoretical Physics at Berlin University of Technology (Technische Universität Berlin). The Technische Universität has a long tradition in science and engineering since its foundation over 125 years ago. It is nowadays a premier research institution with many international cooperations.

As the capital of Germany, Berlin is a center of science and research with many research institutions of high academic reputation. It is also a very green city with many parks, lakes around the city, and a lot of interesting sites to visit in the nearby area. Because of a wide range of cultural facilities in a very open-minded environment and because of Berlin’s historical importance, the candidate will benefit from a lot of stimulating impressions not only from scientific work in our group but also from the city of Berlin itself.