

## **Theoriekolloquium**

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Am **25. November 2010** um **14.15 Uhr** in **W2 1-143** hält

**Herr Prof. Dr. Wolfgang Kinzel (Uni Würzburg)**

einen Vortrag mit dem Titel

### **Chaos synchronization**

A network of chaotic units interacting with time-delayed couplings can synchronize completely. Although the signals are transmitted with arbitrary long delay time, chaos synchronization occurs without any time shift (zero lag synchronization, ZLS).

Chaos synchronization is investigated in the context of cryptography. The transmitted chaotic signal is a carrier for a secret message. A bi-directional coupling between a pair of chaotic units suggests a novel method for public cryptography: Although the algorithm and the transmitted message is known to an attacker, she cannot encrypt the secret message (1).

An important example of ZLS is a pair of semiconductor lasers coupled by their mutual laser beams. The delay of the transmission generates a chaotic laser intensity. For this system, ZLS is possible when either a self-feedback is added to the two lasers or when the transmitted beam has two delay times with special integer ratios (2).

The properties of chaotic networks can be studied analytically for a system of Bernoulli maps. The method of the master stability function allows to relate ZLS to the eigenvalue gap of the coupling matrix. The theory of stochastic matrices gives conditions for ZLS in general networks. For multiple delay times, the theory of polynomials allows to calculate phase diagrams for ZLS. A general argument on mixing of the information of the trajectory of the chaotic units gives conditions for complete or partial ZLS for general networks with multiple delay times. Even networks with uni-directional couplings show ZLS. For this case, optimal networks are found by numerical methods of combinatorial optimization.

The analytic results derived for Bernoulli networks are compared with numerical simulations of laser rate equations and experiments on semiconductor lasers.

Interessierte sind herzlich eingeladen.

gez. Prof. Dr. Alexander Hartmann