

# Module: Elective Advanced Lectures: Applied Physics

Module No.: physics70b

Course:  universität**bonn**

## Physics in Medicine: Fundamentals of Analyzing Biomedical Signals (A)

Course No.: physics772

| Category | Type                   | Language | Teaching hours | CP | Semester |
|----------|------------------------|----------|----------------|----|----------|
| Elective | Lecture with exercises | English  | 3+1            | 6  | WT       |

### Requirements for Participation:

#### Preparation:

Elementary thermodynamics; principles of quantum mechanics, principles of condensed matter

#### Form of Testing and Examination:

Requirements for the examination (written or oral): successful work with the exercises

#### Length of Course:

1 semester

### Aims of the Course:

Understanding of the principles of physics and the analysis of complex systems

### Contents of the Course:

Introduction to the theory of nonlinear dynamical systems; selected phenomena (e.g. noise-induced transition, stochastic resonance, self-organized criticality); Nonlinear time series analysis: state-space reconstruction, dimensions, Lyapunov exponents, entropies, determinism, synchronization, interdependencies, surrogate concepts, measuring non-stationarity.

Applications: nonlinear analysis of biomedical time series (EEG, MEG, EKG)

### Recommended Literature:

Lehnertz: Skriptum zur Vorlesung

E. Ott; Chaos in dynamical systems (Cambridge University Press 2. Aufl. 2002)

H. Kantz, T. Schreiber ; Nonlinear time series analysis. (Cambridge University Press 2:Aufl. 2004).

A. Pikovsky, M. Rosenblum, J. Kurths; Synchronization: a universal concept in nonlinear sciences (Cambridge University Press 2003)