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Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: **G. Ertl**

Organizers: **M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, H. Stark**

Friday, 10th June 2011, 16:00 s.t.

Prof. Dr. Günter Radons

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Nonlinear Dynamics of Complex Hysteretic Systems

Abstract

Under the influence of external fields a large variety of materials and systems shows complex hysteretic behavior. The latter means that in addition to major hysteresis loops, one finds many subloops or minor loops, if the external field is reversed or oscillates at some intermediate values. Well-known examples range from adsorption in porous materials to the magnetization of magnetic materials. Such a behavior is traditionally described by so-called hysteresis operators, for which the Preisach operator is one of the most prominent representatives [1]. Correspondingly, the interaction of such hysteretic systems with its environment is naturally described by operator-differential equations. Despite its importance and its ubiquitous appearance, the dynamics resulting from such equations is not well understood.

In this talk I will review the working principles of the Preisach hysteresis operator and its applications. Subsequently recent results on dynamical systems with such hysteretic subsystems will be presented. They range from the appearance of 1/f-noise under simple input-output conditions [2]to the co-existence of infinitely many attractors for operator-difference or operator-differential equations describing e.g. the motion of an iron sample in an inhomogeneous magnetic field.

References:

[1]G. Bertotti, I.D. Mayergoyz (Eds.), The Science of Hysteresis, Vol. I-III, Elsevier, Amsterdam, 2006.

[2]G. Radons, Phys. Rev. Lett. 100, 240602 (2008), Phys. Rev E 77, 061133 (2008), Phys. Rev E 77, 061134 (2008).

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