SYSS 1.7 Thu 11:15 BAR Schö

Xenon Dendrites: Onset and Amplitude of Sidebranches — •Oliver Wittwer and Jörg Bilgram — Laboratorium für Festkörperphysik, ETH, CH 8093 Zürich, Switzerland

The initiation of sidebranches of three dimensional xenon dendrites has been studied. The sidebranches of dendrites growing in a steady state are initiated by selective amplification of thermal noise in the region of the dendrite tip. Measurements of the amplitudes of sidebranches as a function of the distance behind the tip have been compared with theoretical predictions for non-axisymmetric needle cystals [1]. Noise initiated sidebranches start to grow 3-7 tip radii behind the tip. The sidebranches growing at the four fins are not correlated and the amplitudes measured in our experiments are in quantitative agreement with the theoretical predictions.

We have also found a second type of sidebranch initiation: External perturbations lead to sidebranches starting to grow directly at the tip. They are highly correlated at the four fins and their amplitudes are higher than the ones of noise initiated sidebranches.

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SYSS 1.8 Thu 11:30 BAR Schö

Self-Organized Electrochemical Assembly of Mesoscale Silver Wires and Dendrites — •Sheng Zhong[1,2], Thomas Koch[1,2], Harald Roesner[2], Horst Hahn[2], Eberhard Nold[3], Dong Wang[4], Mu Wang[5], Stefan Walheim[2], and Thomas Schimmel[1,2] — [1]Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — [2]Institute of Nanotechnology (INT), Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [3]Institute for Materials Research I (IMF I), Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [4]Institute for Materials Research II (IMF II), Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [5]National Laboratory of Solid-State Microstructures, Nanjing University, Nanjing 21009, China

Mesoscopic metal structures attract considerable attention due to their potential application in next-generation electronic devices, such as interconnects and active components. The synthesis of these mesoscale building blocks is a crucial step towards the implementation of nanodevices. We demonstrate a novel and simple electrochemical deposition approach for the self-assembly of free-standing single-crystalline mesoscopic silver wires and regular dendritic structures from an aqueous solution without templates, additives and surfactants. The single-crystalline silver wires and structures grow spontaneously under a direct current electric field. Wire diameters down to 100 nm and wire lengths up to 150 micro meter and more are found. This simple electrodeposition system using a growth process that can be observed in situ also opens a convenient way to study the electrochemical growth mechanism in order to tailor mesostructures on this length scale.

SYSS 1.9 Thu 11:45 BAR Schö

Pattern formation in the CO + O reaction on Ir(111) surfaces under the influence of noise — •Stefan Wehner[1], Patrick Hofmann[2], Dieter Schmeisser[2], Helmut R. Brand[3], and Jürgen Küppers[1,4] — [1]Experimentalphysik III, Universität Bayreuth, 95440 Bayreuth, Germany — [2]Angewandte Physik II, Brandenburgische Technische Universität Cottbus, 03013 Cottbus, Germany — [3]Theoretische Physik III, Universität Bayreuth, 95440 Bayreuth, Germany — [4]Max-Planck-Institut für Plasmaphysik (EURATOM Association), 85748 Garching, Germany

The rate of CO oxidation on Ir(111) surfaces exhibits bistability at $T = 500$ K in a range of the CO fraction Y in the CO + O reactant gas flux. Quadrupol mass spectrometer measurements of the CO_2 rates as a function of the noise strength imposed on Y are well reproduced by parameter-free modeling.

We present Photoelectron emission microscopy (PEEM) measurements and 2D calculations of the spatio-temporal patterns of CO and O rich domains. The role of combined multiplicative and additive noise on Y for CO and O domain wall motion and island nucleation-growth-coalescence processes is analysed.

For small noise amplitudes few islands nucleate and grow up to some 100 μm in diameter, before they merge with another island. With increasing noise amplitudes more islands nucleate. With large noise amplitudes bursts to and switching between the branches is observed. The domain wall velocity is found to be independent of the noise strength and island size.

SYSS 1.10 Thu 12:00 BAR Schö

Spatio-temporal dynamics of a fuel cell reaction system: New oscillatory mechanism, bifurcation analysis and efficiency improvement — •Nilüfer Baba[1], Jan Siegmeier[1], Antoine Bonnefont[2], and Katharina Krischer[1] — [1]Physik Department, E19, Technische Universität München, James Franck Str. 1, D - 85748 Garching bei München, Germany — [2]Laboratoire d'Electrochimie et de Chimie Physique du Corps Solide, UMR - Université Louis Pasteur - C.N.R.S. 4, rue Blaise Pascal, 67000 Strasbourg, France

Fuel cells are promising energy conversion devices and much research effort is focussed on their improvement. One considerable problem is that the fuel gas (hydrogen) is contaminated by CO when produced from methane which constitutes the main H_2 source. CO acts as a poison since it absorbs on the Pt catalyst, blocks hydrogen oxidation and reduces the efficiency.

We present a mathematical model for the $H_2/CO/Pt$ system and its bifurcation analysis. We demonstrate that the system displays a novel type of oscillations, involving a slow chemical autocatalysis of surface adsorbed species and a fast negative feedback loop involving the electric potential. The latter, however, is switched off in the presence of a high poison coverage, which enables potentiostatic oscillations in a wide parameter range. Simulations also show Turing patterns of small wavelengths. Based on these results we discuss control techniques that stabilize the system in a state where the coverage is minimized and thus the efficiency is enhanced.

SYSS 1.11 Thu 12:15 BAR Schö

Pulse propagation in excitable media at the edge to oscillatory kinetics. — •Grigori Bordiougov, Georg Roeder, and Harald Engel — Institut fuer Theoretische Physik, TU Berlin, Hardenbergstr. 36 10623 Berlin

Small amplitude oscillations in the wake of solitary pulses are shown to have a strong impact on the interaction between excitation pulses. Annihilation of colliding pulses is replaced by reflective collision. In addition to this soliton-like behavior we find bistability in the dispersion curve for periodic pulse trains [1]. Close to the Canard explosion in the local dynamics we observe break-up of the dispersion curve into disconnected branches accompanied by the formation of isolas [2]. Our results shed new light on the still open mechanism of the transition between trigger and phase waves in reaction-diffusion systems [3]. The reported behavior is generic for a whole class of media with an unique homogeneous steady state that undergoes a supercritical Hopf-bifurcation with Canard explosion due to well separated time scales (so-called type II excitable systems [4]).

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SYSS 1.12 Thu 12:30 BAR Schö

Coherent structures in nonequilibrium wave dynamics — •Benno Rumpf[1], Guenter Radons[1], Alan Newell[2], and Laura Biven[3] — [1]Physics Institute, TU Chemnitz, 09107 Chemnitz, Germany — [2]Mathematics Department, University of Arizona, Tucson, Arizona, USA — [3]Max-Planck-Institut fuer Physik komplexer Systeme, 01187 Dresden, Germany

Turbulence of dispersive nonlinear waves transfers energy from a long spatial scale, where a driving force is applied, to a short viscous scale. In many physical systems, the wave amplitude is almost everywhere small, while strongly nonlinear structures with high amplitudes emerge intermittently. Our study of these coherent structures in nonequilibrium systems is based on a simple statistical analysis of a wide class of Hamiltonian wave equations. The formation of coherent structures depends critically on the thermodynamic parameters of the low-amplitude waves, and on the frequency of coherent structures.

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[2] B.Rumpf, A.C.Newell, Intermittency as a consequence of turbulent transport in nonlinear systems, Phys.Rev.E 69, 026306, (2004)
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