DY 34 Poster

Zeit: Montag 15:30–18:00 Raum: Poster TU D

DY 34.1 Mo 15:30 Poster TU D

Analytic properties of the Ruelle ζ–function for mean field models of phase transition — •Sarah Hallerberg[1], Wolfram Just[2], and Günter Radons[1] — [1]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [2]School of Mathematical Sciences, Queen Mary / University of London, Mile End Road, London E1 4NS, UK

ζ–functions are an important concept in different fields of theoretical physics, like equilibrium statistical mechanics, nonlinear dynamics, or semiclassical descriptions of chaotic quantum systems. Of particular interest are analytical properties of ζ–functions as they reflect nontrivial features like dynamical instabilities or phase transitions. For a simple globally coupled spin system we compute explicitly the Ruelle ζ–function. We study in detail how the ferromagnetic phase transition is reflected by changes in the analytical properties of the ζ–function.

DY 34.2 Mo 15:30 Poster TU D

Bonding of Hydrogen in Palladium Clusters: A molecular-dynamics study. — •Diana Marcano, H. Teichler, and A. Pundt — Institut fuer Materialphysik, Universitaet Goettingen

The binding energy of Hydrogen (H) in a fcc-Palladium (Pd) cluster (923 atoms) is studied with molecular-dynamics simulations. The Pd-H system was modelled using a "many body alloy potential"(MBAP) (Tomanek,1991) and a new pair potential with parameters chosen to reproduce the bulk modulus, dipole force tensor and local lattice expansion. We were mainly concerned with the dependance of the H binding energy on the distance from a free surface, caused by the dynamics of the surface, the near surface and the atoms inside the cluster. Starting with 1 H-atom sitting at one site up to more H-atoms in different sites. Both potentials results will be compared and their advantages will be discused. This contribution is supported by the DFG via SFB602 and the DAAD.

DY 34.3 Mo 15:30 Poster TU D

Calculating the degrees of freedom governing dynamical systems — •Sebastian Getfert[1], Javier Rodriguez-Laguna[2], and Andreas Degenhard[1] — [1]Fakultät für Physik, Universität Bielefeld, Postfach 100131, 33501 Bielefeld — [2]Instituto de Fisica Teorica, UAM-CSIC, Madrid, Spain

The numerical analysis of dynamical systems that are described by evolutionary partial differential equations (PDEs) is inevitably connected with field discretization. Therefore, efficient computations are often difficult due to the high number of degrees of freedom involved.

For equilibrium phenomena Real Space Renormalization Group Methods were successfully developed to reduce the number of degrees of freedom. Here we investigate the use of such methods for dynamical systems [1]. Our approach is based on the construction of a reduction operator that projects the system to a subspace including only a restricted subset of all the degrees of freedom. The reduction operator concept explicitly allows for selecting the relevant degrees of freedom, i.e. those that dominate the time evolution of the system under consideration. As the final result we obtain a reduced description for the evolution of the PDE, thereby increasing the computational efficiency.

[1] Degenhard A., Rodriguez-Laguna J., J. Stat. Phys. 106, 1093 (2002)

DY 34.4 Mo 15:30 Poster TU D

Dynamics of liquid crystals with an improved Landau-de Gennes potential — •Sebastian Heidenreich, Patrick Ilg, and Siegfried Hess — Institut für Theoretische Physik, Technische Universität Berlin, D-10623, Germany

In liquid crystals, the dynamic of orientation can be described by a constituive equation of the alignment tensor **a** within the framework of irreversible thermodynamics [1] where the time evolution of **a** is determined by the velocity gradient and the derivative of the standard Landau-de Gennes potential.

Here, we propose an improved Landau-de Gennes potential based on Onsager's excluded volume potential of rigid rods and the generating momentum equation found by Öttinger et. al [2].

In contrast to the standard Landau-de Gennes potential our potential has the advantage to restrict the orientation to physically admissible values. The effect of the improved Landau-de Gennes potential on the dynamical behavior and viscous properties is investigated.

[1] S. Hess, Z. f. Naturforsch. **30a**, 728 (1975); S. Hess and I. Pardowitz, Z. f. Naturforsch. **36a**, 554 (1981); C. Pereira Borgmeyer and S. Hess, J. Non-Equilib. Thermodyn. **20**, 359 (1995)

[2] P. Ilg, V. Karlin and H. C. Öttinger, Phys. Rev. E **60**, 5783 (1999)

DY 34.5 Mo 15:30 Poster TU D

Lambert diffusion in three-dimensional porous media in the Knudsen regime — •Stephan Zschiegner[1,2], Stefanie Russ[1], Armin Bunde[1] und Jörg Kärger[2] — [1]Institut für Theoretische Physik III, Justus-Liebig-Universität, Giessen — [2]Institut für Experimentelle Physik I, Universität Leipzig, Leipzig

In general, diffusion of gas particles depends on the collisions between the gas molecules as well as on the collisions of the gas with the pore walls. Of particular interest for many real gases is the range of the so-called Knudsen regime, where the interaction of the molecules with the pore walls plays the crucial role and the intramolecular collisions can be neglected.

Here we present a new method to compute three-dimensional Knudsen diffusion in porous media. The trajectory of the diffusing particles is calculated using cube elements that assemble the porous system. The new algorithm is easy to implement in diffusion simulations and saves computation time due to its linear dependence on the system size.

For mimicking pores with different roughness, we consider the first four iterations of a generalized fractal Koch curve in three dimensions. For these model pores we have performed detailed investigations of self diffusion and transport diffusion. Our results show that both kinds of diffusion coefficients decrease with increasing surface roughness of the pores.

DY 34.6 Mo 15:30 Poster TU D

Large and small avalanches in the Olami-Feder-Christensen earthquake model — •Felix Wissel and Barbara Drossel — Institut f. Festkoerperphysik, TU Darmstadt, Hochschulstrasse 6, 64289 Darmstadt

We investigate the nature of the different types of avalanches occurring in the Olami-Feder-Christensen Earthquake model. Analytical considerations and computer simulations of the one-dimensional model show that for sufficiently large systems the distribution of small avalanches is independent of the system size, while that for large avalanches is proportional to the system size due to large synchronized blocks. We analyze how these results are changed when the symmetry of the system is broken or quenched randomness is introduced. We compare the one- and two-dimensional system and make a prediction for the behavior of the avalanche-size distribution in 2 dimensions in the limit of large system size. This leads to the question in what sense the OFC-model can be considered as self-organized critical.

DY 34.7 Mo 15:30 Poster TU D

Long-term persistence and clustering of extreme events in climate records — •Jan Kantelhardt[1,2], Jan Eichner[2], Armin Bunde[2], and Shlomo Havlin[3] — [1]FB Physik und Zentrum für Computational Nanoscience, Martin-Luther-Universität, 06099 Halle (Saale), Germany — [2]Institut für Theoretische Physik III, Justus-Liebig-Universität, 35392 Giessen, Germany — [3]Minerva Center and Department of Physics, Bar-Ilan University, Ramat-Gan 52900, Israel

We study the long-term persistence and the statistics of the return intervals between extreme events above a certain threshold in measured, reconstructed, and surrogate climate records. While long-term memory is rather universal in the measured temperature series, we find that some of the reconstructed local and global records show significant deviations. For the reconstructed records with long-term scaling and for surrogate data we find three consequences of long-term persistence: (i) a stretched exponential distribution of the return intervals, (ii) a pronounced clustering of extreme events and (iii) an anomalous behavior of the mean residual time to the next event that depends on the history and increases with the elapsed time in a counterintuitive way. The phenomena should also occur in heartbeat records, internet traffic and stock market volatility and have to be taken into account for an efficient risk evaluation.

DY 34.8 Mo 15:30 Poster TU D

Mosaikartige Strukturen in optischen Rückkopplungssystemen — •Guido Krüger und Rudolf Friedrich — Institut für Theoretische Physik, Wilhelm-Klemm-Str. 9, 48149 Münster

Musterbildung in optischen Einspiegel Rückkopplungssystemen mit einer Nichtlinearität ist seit langem bekannt. Zu den Mustern die in diesem System auftreten zählen Quadrate, Hexagone, Rollen, Spiralen, solitäre Strukturen und blumenartige Muster (Quasipatterns).

Das hier untersuchte System hat im Gegensatz zu den sonst untersuchten RKSystemen zwei Nichtlinearitäten und damit auch mehrere charakteristische Längenskalen. Ein nichtlinearer Effekt dieser Anordnung ist eine sogenannte Mosaik-Instabilität. Die erste Instabilität die in diesem System auftritt bringt typischerweise Quadrate hervor. Höhere Instabilitäten in diesem System bringen mosaikartige Strukturen hervor und der Übergang zu Quasiperiodischen Mustern wird diskutiert.

DY 34.9 Mo 15:30 Poster TU D

On the theory of the shear-induced isotropic-to-nematic phase transition of side chain liquid-crystalline polymers — •Patrick Ilg and Siegfried Hess — Institut für Theoretische Physik, Technische Universität Berlin

The shear-induced isotropic-to-nematic phase transition of side chain liquid-crystalline polymers is studied theoretically. A modification of previous models of main-chain liquid crystals [1] to the case of side chain liquid-crystalline polymers is proposed. Orientational and rheological properties of the model are studied in plane shear flow [2].

It is found that the coupling of the mesogenic side chains to the polymer back bone modifies the dynamical properties considerably. For example the shear-induced isotropic-to-nematic transition is shifted compared to ordinary nematics and liquid crystals. Due to the different relaxation times of the side chains and the polymer back bone, a stress plateau is observed. Predictions of the present model agree qualitatively with experimental results [3].

[1] S. Hess, Z. Naturforsch. 31a, 1507 (1976).
[2] S. Hess, P. Ilg, submitted to Rheol. Acta.
[3] C. Pujolle-Robic, L. Noirez, Nature 409, 167 (2001).

DY 34.10 Mo 15:30 Poster TU D

Oscillating traveling pulses in a two-component reaction-diffusion model — •E. P. Zemskov[1], G. V. Bordiougov[1], H. Engel[1], J. Fort[2], and V. Méndez[3] — [1]Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstrasse 36, 10623 Berlin, Germany — [2]Departament de Física, Universitat de Girona, Campus de Montilivi, 17071 Girona, Catalonia, Spain — [3]Departament de Medicina, Universitat Internacional de Catalunya, c./Gomera s/n, 08190 Sant Cugat del Vallès, Barcelona, Spain

We consider traveling wave solutions with oscillatory tails in the one-dimensional, double diffusive Rinzel-Keller model which represents the piece-wise linear approximation of the cubic nonlinearity in the famous FitzHugh-Nagumo model for signal propagation in neural tissue. We prove the existence and the stability of those solutions in a certain range of the time scale ratio of the activator and the inhibitor as well as of the excitation threshold. Furthermore we discuss the dependence of the pulse velocity on these two parameters characterizing basic properties of the excitable medium.

DY 34.11 Mo 15:30 Poster TU D

Periodically controlled qubit system coupled to an environment — •Marcus Stollsteimer and Günter Mahler — Universität Stuttgart, Institut für Theoretische Physik 1, Pfaffenwaldring 57, D-70550 Stuttgart

We study the thermodynamic properties of a small quantum system which is subject to periodic external parameter control (Floquet-type system). This system proper is coupled to another quantum system that acts as environment or "bath". We consider the existence of "quasi-equilibrium" states, similar to the equilibrium states of the zero-control case, and the characteristics of these states.

DY 34.12 Mo 15:30 Poster TU D

Rauschfreier Grenzfall einer Ferroluid Ratsche und rotierende Ferrofluid Ratschen — •Volker Becker und Andreas Engel — Carl-von-Ossietzky-Universität, 26111 Oldenburg

Magnetische Nanopartikel in einem Ferrofluid können unter dem Einfluss eines oszillierenden magnetischen Feldes als thermische Ratsche arbeiten. Bei geeigneter Wahl der Zeitabhängigkeit des magnetischen Feldes wird durch Gleichrichtung thermischer Fluktuationen ein mittleres Drehmoment auf ein in Ruhe befindliches Ferrofluid ausgeübt, obwohl das Feld selbst keinen rotierenden Anteil enthält. Durch Untersuchung des deterministischen Grenzfalls der Dynamik wurde gezeigt, dass die thermischen Fluktuationen für den beschriebenen Effekt in der Tat unverzichtbar sind, was in der Literatur zuvor bezweifelt wurde. Weiterhin wurde der Fall untersucht, in dem das Ferrofluid nicht ruht, sondern mit konstanter Winkelgeschwindigkeit rotiert, sowie das Zusammmenspiel des Ratscheneffekts mit einer bei höheren Frequenzen auftretenden symmetriebrechenden Instabilität untersucht.

DY 34.13 Mo 15:30 Poster TU D

Scaling of energy barrier in two-dimensional spin glasses — •Carlo Amoruso[1,2], M.A. Moore[2], and Alexander K. Hartmann[1] — [1]Institut für Theoretische Physik, Friedrich-Hund-Platz 1, 37077 Göttingen — [2]Department of Physics and Astronomy, University of Manchester, Manchester, M13 9PL, United Kingdom

Energy barriers determine the dynamics of glassy systems that have a complex energy landscape with many metastable states, like spin glasses. In the droplet approach a central role is played by an exponent θ which characterizes the energetics of large scale excitation from the ground state. Such excitation scale like as L^θ. The system orders at low temperature if $\theta > 0$. The dynamics is controlled by the rate of creation of those excitations, and it is generally assumed that the barrier against this relaxation scales as L^ψ where $\theta \leq \psi \leq d-1$ for dimension d. We study the case of $d = 2$ spin glasses, where $\theta \approx -0.28$. We are using an optimization procedure [1], based on combinatorial matching algorithms, and suitable modifications of the disorder [2], which allows us to treat relative large samples. Using this approach, we are able to give the bounds $+0.28 < \psi < 0.58$.

[1] A.K. Hartmann and H. Rieger, *Optimization Algorithms in Physics, Wiley-VCH (2001)*
[2] A.K. Hartmann and M.A. Moore, Phys. Rev. Lett. **90**, 127201 (2003)

DY 34.14 Mo 15:30 Poster TU D

The effect of long-term correlations on the statistics of maxima — •Jan Eichner[1], Armin Bunde[1], Jan Kantelhardt[2], and Shlomo Havlin[3] — [1]Institut für Theoretische Physik III, Universität Giessen, Germany — [2]Fachbereich Physik und Zentrum für Computational Nanoscience, Martin-Luther-Universität Halle-Wittenberg, Germany — [3]Minerva Center and Department of Physics, Bar-Ilan University, Ramat-Gan, Israel

In common extreme value statistics one assumes that rare extreme events separated by a long time span are statistically independent (Extremal Types Theorem). Here we consider long-term correlated records, where the autocorrelation function $C(s)$ decays as $s^{-\gamma}$ with $0 < \gamma < 1$. Long-term correlations appear in many natural records, e.g. in temperatures, river flows, heartbeat intervals, and also in financial volatility records. Here we study artificial Gaussian distributed long-term correlated records. The records are segmented in windows of size R. The quantity we are interested in is the maximum-value m_i in each window i. We find that the sequence of these maxima is also long-term correlated, such that large maxima are more likely to be followed by large maxima, and small maxima by small maxima. This effect can be clearly seen in the (conditional) distribution of those m-values, that directly follow a fixed m_0-value. We show explicitly that the probability for the next event m to be larger than a certain threshold-value M depends significantly on the preceding event m_0, an effect that has to be taken into account in any risk estimation.

DY 34.15 Mo 15:30 Poster TU D

A new beam model for delamination of composite materials — •Frank Raischel[1], Ferenc Kun[2], and Hans J. Herrmann[1] — [1]Institut für Computerphysik, Universität Stuttgart, D-70569 Stuttgart — [2]Department of Theoretical Physics, University of Debrecen, H-4010 Debrecen

We present a novel model for shear failure of a glued interface between two solid blocks, which is a model system for the fiber-matrix interface in composite materials. The interface is treated as an array of elastic beams, which experience stretching and bending under shear load. Breaking is initiated if the two deformation modes exceed randomly distributed breaking thresholds, and global load sharing following the breaking of one beam can trigger avalanches in the system. We provide theoretical and simulation results for both the macroscopic behaviour and the microscopic dynamics, and compare our findings with experiments and the

commmonly used dry fiber bundle models.

DY 34.16 Mo 15:30 Poster TU D

Electron-Polarization Coupling in Superconductor-Ferroelectric Superlattices — •Natalia Pavlenko[1,2] and Franz Schwabl[2] — [1]Institute of Physics, University of Augsburg, 86135 Augsburg, Germany — [2]Institute of Theoretical Physics, Department of Physics, Technical University og Munich, 85747 Garching, Germany

We present a phenomenological model of periodic ferroelectric-superconductor (FE-S) heterostructures containing two alternating ferroelectric and superconducting layers. The interaction at the FE-S contacts is described as a coupling of the local carrier density of the superconductor with the spontaneous ferroelectric polarization near the FE-S interface. We obtain a stable symmetric domain-type phase exhibiting a contact-induced polarization and the ferroelectric domain structure at temperatures above the bulk ferroelectric transition temperature. The system is analyzed for different thicknesses of the FE- and S-films demonstrating the dramatic change of the topology of the phase diagrams with a variation of the layers thickness. The results are expected to shed light on processes occurring in high-temperature superconducting films grown on perovskite alloy-substrates exhibiting ferroelectric properties at lower temperatures.

DY 34.17 Mo 15:30 Poster TU D

Identification of Ion Sites in Glasses — •Christian Müller[1], Hartmut Grille[1], Junko Habasaki[2], and Philipp Maass[1] — [1]Institut für Physik, Technische Universität Ilmenau, Germany — [2]Tokyo Institute of Technology, Japan

To understand the dynamics of ions in glasses from a microscopic viewpoint it is necessary to identify and to characterise the available sites for the mobile ions in the glassy network. Efforts in this direction have been undertaken by means of molecular dynamic simulations. In these simulations it has been counted how many times a cell within the simulation box is visited by a mobile ion within a given (large) time period [1]. Using this procedure ion sites as well as their occupation probabilities are obtained. Here we focus on the question if it is possible to identify these sites on the basis of equilibrium configurations. Therefore we analyze the ionic potential energy surface with respect to the minima and their connectivity features.

[1] J. Habasaki and Y. Hiwatari, Phys. Rev. B **69**, 144207 (2004)

DY 34.18 Mo 15:30 Poster TU D

Mechanical analysis of polymer glasses — •Jörg Hachenberg, Peter Rösner, and Konrad Samwer — I. Physikalisches Institut, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen

The mechanical behaviour of polymers close to the glass-transition-temperature is of great industrial interest but still not fully understood on molecular scale. In this work, mechanical spectroscopy and creep recovery measurements are performed highlighting the material properties at low frequencies / long times and the response to dynamic or static loads. PMMA has been chosen as a model system and shows interesting anelastic and Non-Newtonian viscoelastic features. This work is supported by the DFG, GRK 782

DY 34.19 Mo 15:30 Poster TU D

Vacancy model reproducing the most important features of the Mixed Alkali Effect — •Robby Peibst, Stephan Schott, and Philipp Maass — Institut für Physik, Technische Universität Ilmenau, Germany

The mixed alkali effect in glasses is a very impressing example of nonlinear behaviour in disordered systems. Some deviations from a simple additive behaviour upon mixing of two types of mobile ions are hardly understood so far, e.g. the limiting slope behaviour of the diffusion constant and the height of the mixed internal friction peak. By taking into account the results of recent molecular dynamik simulations as well as cognitions of preceding own investigations, we present a plausible vacancy model which is able to explain also these key problems. Furthermore, we discuss several possiblities for a general approach to transport processes in dense disorderd systems.

[1] H. Lammert, M. Kunow, and A. Heuer, Phys. Rev. Lett. **90**, 215901 (2003)
[2] J. Habasaki and Y. Hiwatari, Phys. Rev. B, in print
[3] Ph. Maass, J. Non-Cryst. Solids **255**, 35 (1999)

DY 34.20 Mo 15:30 Poster TU D

Neural Cryptography with Queries — •Andreas Ruttor and Wolfgang Kinzel — Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, 97074 Würzburg

Neural cryptography is based on synchronization of tree parity machines by mutual learning. We extend previous key-exchange protocols by replacing random inputs with queries depending on the current state of the neural networks. The probability of a successful attack is calculated for different model parameters using numerical simulations. The results show that queries restore the security against cooperating attackers. The probability of success can be reduced without increasing the average synchronization time.

DY 34.21 Mo 15:30 Poster TU D

Supervised and unsupervised vector quantization: a solvable model — •Michael Biehl and Anarta Ghosh — Institute of Mathematics and Computing Science, University of Groningen, P.O. Box 800, 9700 AV Groningen, The Netherlands

Unsupervised Vector Quantization (VQ) and supervised (Learning) Vector Quantization (LVQ) are intuitively clear and widely used methods for the analysis of large amounts of structured data. In the former, the aim is the representation of data by a limited number of prototype vectors. In the latter, prototypes serve as reference vectors for a classification based on appropriate distance measures. We apply statistical physics methods in order to study analytically the dynamics and stability of various learning algorithms in a model situation. In particular, we compare unsupervised competitive learning with Kohonen's original formulation of LVQ and several modifications thereof. Recent attempts to identify appropriate cost functions for LVQ are also taken into account. We show that many appearently plausible approaches suffer from instability problem, in particular when the data belongs predominantly to one of the classes. The development of simple prescriptions which approximate (Bayes) optimal classification schemes under rather general circumstances is in the center of our interest.

DY 34.22 Mo 15:30 Poster TU D

Thermodynamics of quantum Brownian motion with internal degrees of freedom — •Christian Hörhammer and Helmut Büttner — Theoretische Physik I, Universität Bayreuth, 95440 Bayreuth

We examine the role of entanglement in the low temperature/ strong-coupling quantum regime and the applicability of thermodynamic relations such as the Clausius inequality. A model of two coupled Brownian oscillators based on the Caldeira-Leggett model is formulated and the influence of the additional internal coupling parameter on heat and entropy changes is described. The results are compared to the case of quantum motion of a single Brownian particle.

DY 34.23 Mo 15:30 Poster TU D

Control of noisy oscillations in the Van-der-Pol system — Jan Pomplun, Alexander Balanov, Andreas Amann, and Eckehard Schöll — Institut für Theoretische Physik, TU Berlin, Hardenbergstr. 36, 10623 Berlin

Effects of delayed feedback on noisy dynamics of the paradigmatic Van der Pol system are studied both analytically and numerically. It is shown that such a feedback in the form proposed earlier by Pyragas for the control of chaotic oscillations can be used for effective manipulation of the statistics of noisy oscillations either above or below the Hopf bifurcation; however, the action of the feedback in those two cases is different. We discuss this difference from the viewpoint of amplitude and phase dynamics and explain its origin.

DY 34.24 Mo 15:30 Poster TU D

Diffusion in time-dependent potentials — •E. Paule[1], Th. Pletl[1], P. Chvosta[2], and P. Reineker[1] — [1]Abt. Theoretische Physik, Universität Ulm, Albert-Einstein-Allee 11, 89069 Ulm — [2]Dep. of Macromolecular Physics, Faculty of Mathematics and Physics, Charles University, V Holešovičkách 2, CZ-180 00Praha, Czech Republic

We investigate numerically the one-dimensional diffusion of a particle in time-dependent potentials. For this purpose we solve the Fokker-Planck equation with the Finite-Element-Method (FEM). The time-dependence of the potential is given by a harmonically modulated force. The mean position of the particle as a function of time is of our interest. We focus on resonance-like behaviour of the response of the system in the stationary limit.

DY 34.25 Mo 15:30 Poster TU D

Impact of weak aperiodic signals on the response of a chaotic system: Noise-free Stochastic Resonance — •Johannes Werner[1], Thomas Stemler[1], Hartmut Benner[1], and Andrzej Krawiecki[2] — [1]Institut für Festkörperphysik, TU-Darmstadt — [2]Faculty of Physics, Warsaw University of Technology

In nonlinear autonomous circuits of the Chua family an attractor merging crisis occurs when two coexisting attractors of the precritical system collide as a control parameter (a resistor R) is increased. The system can then jump intermittently between those two subattractors. These jumps can be influenced by a weak signal that is fed into the system. Depending on the control parameter the correlation between input signal and system response varies, reaching several extrema on variation of the control parameter R. This is due to the effect of noise-free stochastic resonance, where the role of the noise is taken on by fast intrinsic dynamics of the system. We show that the dependency of the mean residence time on the control parameter has huge impact on the system's response behaviour and thus on the cross correlation between input and output. We compare the experimental results obtained with different aperiodic signals — bandwidth limited and dichotomic noise — to theoretical predictions derived from linear response theory.

DY 34.26 Mo 15:30 Poster TU D

Noise-induced order and ratchet effect in a thermal convection loop — •Chol-Ung Choe[1,2] and Hartmut Benner[1] — [1]Institut für Festkörperphysik, TU-Darmstadt — [2]Department of Physics, University of Science Pyongyang, DPR Korea

We show analytically and experimentally that noise-induced order as well as ratchet effects are efficiently achieved by applying vertical and horizontal noise fluctuations on a thermal convection loop. The idea of our investigation is based on the observation that a thermal convection loop shows stability properties similar to those of the well-known Kapitza pendulum which can be stabilized or destabilized by rapid vibrations of its pivot. The mechanism of fast parametric modulation by regular oscillations could be extended to the case of irregular fluctuations.

DY 34.27 Mo 15:30 Poster TU D

The influence of measurement noise on esimating drift and diffusion coefficients — •Frank Böttcher and Joachim Peinke — Carl von Ossietzky University of Oldenburg

A new method of analysing measurement noise which is superimposed to a dynamical system is presented. It is shown that it is possible to distinguish between external measurement noise and dynamical noise which is an intrinsic part of the process. The distinction is based on the evaluation of the conditional moments that exhibit an increased offset with increasing measurement noise. It is found that the first moment shows an unexpected offset the second moment a modified one compared to the findings of earlier works.

For an Ornstein-Uhlenbeck process it is analytically possible to reconstruct the underlying process dynamics even for very large external noise amplitudes.

DY 34.28 Mo 15:30 Poster TU D

A tomographic study of a meandering scroll wave in a chemical excitable media — •Chaiya Luengviriya, Ulrich Storb, and Stefan C. Müller — Otto-von-Guericke-Universität, Institut für Experimentelle Physik, Universitätsplatz 2, D-39106 Magdeburg

The behavior of a meandering scroll wave in a ferroin-catalyzed MABZ reaction solution embedded in agarose gel is studied by optical tomographic observation with a parallel beam technique. The chemical recipe for the meandering case with extremely low wave velocity (less than 25 um/s) is firstly obtained from a 2D experiment with a special oxygen-free 2D reactor.In the 2D case the media supports a meandering spiral wave at the beginning of the experiment. Due to aging, the shape of the trajectory of the spiral tip changes from four-outer petals to three-outer petals and finally the spiral tip rotates rigidly. Using this recipie in the 3D case a scroll wave with a straight vertical filament is initiated. In the course of time the scroll wave exhibits a uniform twist rate all along its filament. This twist rate increases and eventually the filament changes to a helical form.

DY 34.29 Mo 15:30 Poster TU D

Breathing and traveling dissipative solitons in a three-component reaction-diffusion system — •Svetlana Gurevich[1], Andreas Liehr[2], Shalva Amiranashvili[1] und Hans-Georg Purwins[1] — [1]Institut für Angewandte Physik, WWU Münster, Corrensstr. 2-4, 48149 Münster — [2]Freiburger Materialforschungszentrum,Stefan-Meier-Str. 21, D-79104 Freiburg

We investigate the stability of the localized solutions in a three-component reaction-diffusion system with one activator and two inhibitors. Changing the time constants of inhibitors leads to the instability of a stationary solution. In many cases the breating mode comes first and the stationary dissipative soliton undergoes a bifurcation from a stationary to a "breathingßtate. On the other hand it is possible to observe a mode responsable for a movement first and a drift-bifurcation take a place. Moreover the interaction between this two modes can be observed. This situations are analyzed performing a multiple scale perturbation expansion up to third order in the vicinity of the bifurcation point. To prove the correctness of the theory, numerical simulations are carried out showing good agreement with the analytical predictions.

DY 34.30 Mo 15:30 Poster TU D

Dissipative solitons on a spiral background in a single-mirror feedback scheme — •Elmar Schöbel, Florian Huneus, Thorsten Ackemann, and Wulfhard Lange — Institut für Angewandte Physik, Westfälische Wilhelms-Universität, Corrensstr. 2/4, 48149 Münster

Most dissipative solitons exist on a stationary and constant background. Here we report on the observation of solitons on a modulated oscillatory state in an optical experiment. Sodium vapor in an oblique magnetic field is irradiated by a laser beam. The transmitted light is retro-reflected into the vapor by a plane feedback mirror.

Above a certain value of the laser intensity, this system generates different structures spontaneously. The regions of existence of dissipative solitons [1] and dynamical spirals [2] overlap under suitable conditions. Then, high-amplitude dissipative solitons on a low-amplitude spiral can be observed. The properties of these coexisting structures and the range of the region of coexistence are investigated experimentally.

[1] B. Schäpers, M. Feldmann, T. Ackemann, and W. Lange. Phys. Rev. Lett. **85**, 748–751 (2000).

[2] F. Huneus, B. Schäpers, T. Ackemann, and W. Lange. Appl. Phys. B **76**, 191–198 (2003).

DY 34.31 Mo 15:30 Poster TU D

Dynamics of hydrodynamic Lyapunov modes in coupled map lattices — •Hong-liu Yang and Günter Radons — Theoretische Physik I, Komplexe Systeme und Nichtlineare Dynamik, TU-Chemnitz

In our study of equal-time correlations of hydrodynamic Lyapunov modes in coupled map lattices, we found that there are two universality classes with different λ-k dispersion relations, $\lambda \sim k^2$ for coupled Hamiltonian maps and $\lambda \sim k$ for coupled dissipative maps. In this paper we perform numerical experiments to determine the form of the dynamic Lyapunov vector (LV) structure factors of coupled map lattices which provide detailed information on the LV dynamics. It is found that the dynamic LV structure factor for coupled circle maps has a single peak at $\omega = 0$ and can be well approximated by a single Lorentzian curve. This implies that the hydrodynamic Lyapunov modes of coupled circle maps are non-propagating and possess only diffusive thermo-motions. In contrast, in the dynamic LV structure factors of coupled standard maps, one observes two pronounced peaks located symmetrically at $\pm\omega_u$. The spectra can be well approximated by three Lorentzian curves centered at $\omega = 0$ and $\pm\omega_u$, respectively. The ω_u-k dispersion relation takes the form $\omega_u = c_u \cdot k$. This implies that the hydrodynamic Lyapunov modes of coupled standard maps are propagating. These findings demonstrate that the HLMs in the two classes of models have different dynamical behavior besides their difference in the spatial structure. The existence of propagating Lyapunov modes in a system without continuous time-translational invariance calls for a new theoretical interpretation different from the one for many-particle systems.

DY 34.32 Mo 15:30 Poster TU D

Echtzeit-Verkehrssimulation in komplexen Autobahnnetzwerken — •Florian Mazur, Roland Chrobok, Sigurdur F. Hafstein, Andreas Pottmeier und Michael Schreckenberg — Universität Duisburg-Essen, Physik von Transport und Verkehr, Lotharstr. 1, 47057 Duisburg

Mit Hilfe von aktuellen Zellularautomatenmodellen ist es mittlerweile möglich, den Verkehr auf komplexen Netzwerken, wie zum Beispiel dem Autobahnnetzwerk in Nordrhein-Westfalen, realitätsnah zu simulieren. Eine derartige Echtzeit-Verkehrssimulation kann man zum Beispiel nutzen, um Informationen über Verkehrszustände auf Autobahnen zu errechnen. In Nordrhein-Westfalen gibt es auf den Autobahnen über 4000 Induktionsschleifen, die online Informationen über das Verkehrsaufkommen an ihrem Standort geben können. Werden nun diese Informationen in einer Simulation berücksichtigt, so ist es möglich, Aussagen über den Verkehr in ganz Nordrhein-Westfalen zu treffen. Diese werden beispielsweise an der Universität Duisburg-Essen aufbereitet und im Internet grafisch abgebildet (http://www.autobahn.nrw.de) und dienen unter anderem zur Routenplanung. Das Konzept einer Echtzeit-Verkehrssimulation ist eine Abbildung des realen Verkehrs im Computer. Dabei wird jedes Fahrzeug mit Hilfe von gemessenen Verkehrsdaten virtuell im Computer nachgebildet. Sehr effektive Modelle mit verhältnismäßig wenig Rechenaufwand sind die so genannten Zellularautomatenmodelle. Mit diesen Modellen ist es möglich, den Verkehr realistisch zu beschreiben und zu analysieren.

DY 34.33 Mo 15:30 Poster TU D

Ein Zellularautomatenmodell für Fußgängerevakuationsdynamik — •Tobias Kretz und Michael Schreckenberg — Universität Duisburg-Essen, Physik von Transport und Verkehr, Lotharstr. 1, 47057 Duisburg

Im Hinblick auf Stauungen potentiell gefährliche Stellen in Gebäuden oder Veranstaltungsorten intuitiv zu erkennen, wird mit zunehmender Komplexität des Grundrisses und des zu bewältigenden Besucheraufkommens schwieriger oder sogar unmöglich. Übungen können - wenn überhaupt - nur in geringer Zahl durchgeführt werden und liefern daher nur Ergebnisse, deren statistische Aussagekraft weitgehend unbekannt bleibt. Einen Ausweg bieten Simulationen, die beliebig oft durchgeführt werden können, sofern das Simulationsmodell auf heute verfügbaren Rechnern auch für große Szenarien (z.B. Stadien) in akzeptabler Zeit durchgerechnet werden kann. Dabei muss bedacht werden, dass für eine breite Anwendbarkeit keine Supercomputer sondern nur handelsübliche Rechner zur Ausführung der Simulation notwendig sein dürfen. Zellularautomatenmodelle erfüllen diese Bedingung in ausgezeichneter Weise, da sie in ihrer Struktur der grundlegenden Architektur aller Arten von Rechenmaschinen entgegen kommen.

DY 34.34 Mo 15:30 Poster TU D

High-Order Variational Calculation for Periodic Orbits — •Axel Pelster[1], Alexey Novikov[2], Ulrich Kleinkathöfer[2], and Michael Schreiber[2] — [1]Fachbereich Physik, Universität Duisburg-Essen, Essen, Germany — [2]Institut für Physik, Technische Universität Chemnitz, Chemnitz, Germany

Following Ref. [1], we develop a convergent variational perturbation theory for periodic orbits of nonlinear dynamical systems. An optimization with respect to artifically introduced variational parameters allows to convert divergent weak-coupling series for periodic orbits into convergent strong-coupling series. At first, the power of the theory is illustrated by applying it to the undamped Duffing oscillator where we obtain an exponentially fast convergence for the time-periodic solution. Then we investigate how our theory can be extended to the damped Duffing oscillator as this model system has many technical similarities with the quantum mechanical damped harmonic oscillator [2].

[1] A. Pelster, H. Kleinert, and M. Schanz: Phys. Rev. E **67**, 016604 (2003).
[2] A. Novikov, U. Kleinekathöfer, and M. Schreiber: J. Phys. A **37**, 3019 (2004).

DY 34.35 Mo 15:30 Poster TU D

Hydrodynamic Lyapunov modes in Lennard-Jones fluids: Dynamic Correlations — •Hong-liu Yang and Günter Radons — Theoretische Physik I, Komplexe Systeme und Nichtlineare Dynamik, TU-Chemnitz

Recently we succeeded in identifying hydrodynamic Lyapunov modes (HLMs) also in chaotic many-particle systems with soft core interactions [1,2]. In contrast to the previously studied hard-sphere systems, this became possible only by considering equal-time correlation functions of the coordinate fluctuation density $u^{(\alpha)}(x,t)$ of the Lyapunov vector (LV) associated with the α-th Lyapunov exponent $\lambda^{(\alpha)}$. This approach can be extended to the study of dynamic correlations of $u^{(\alpha)}(x,t)$ [2]. We present detailed results for the corresponding dynamic LV structure factors. They provide us, in addition to the Lyapunov exponent - wave vector dispersion, with the collective dynamic excitations of a given Lyapunov vector. The linear ω-k dispersion relation, which can be extracted from the "inelastic" peak of a numerical 3-pole approximation of the dynamic LV structure factor, implies that the hydrodynamic Lyapunov modes are propagating. We present results for the density dependence of the corresponding propagation velocities. Results for the k-dependence of the linewidth of the observed central peak are also elaborated.

[1] H.Yang and G. Radons, nlin.CD/0404027
[2] G. Radons and H. Yang, nlin.CD/0404028

DY 34.36 Mo 15:30 Poster TU D

Hydrodynamic Lyapunov modes in coupled map lattices: spatial correlations — •Hong-liu Yang and Günter Radons — Theoretische Physik I, Komplexe Systeme und Nichtlineare Dynamik, TU-Chemnitz

We present numerical and analytical results, which show that hydrodynamic Lyapunov modes (HLMs) also exist for coupled map lattices (CMLs). It is found that the dispersion relations, Lyapunov exponent vs. wave number, of these modes fall into two different universality classes. We obtain $\lambda \sim k$ e.g. for coupled standard maps and $\lambda \sim k^2$ for coupled circle maps. We discuss under which conditions HLMs can be observed. The role of the Hamiltonian structure, conservation laws, translational invariance, mass-disorder, and damping terms is elaborated. Furthermore, we present simulation results for two-dimensional lattices of coupled maps showing that the appearance of HLMs in CMLs is not restricted to the one-dimensional case.

DY 34.37 Mo 15:30 Poster TU D

Information processing in cellular automata with delay — •Thimo Rohlf and Jürgen Jost — Max-Planck-Institute for Mathematics in the Sciences, Inselstr. 22, D-04103 Leipzig, Germany

We investigate dynamics and information processing in cellular automata with delays in signal propagation. Dynamics is characterized using concepts from Statistical and Computational Mechanics, and compared to conventional cellular automata. The information processing properties of this new class of dynamical systems are demonstrated by application to non-trivial tasks in pattern recognition (e.g., density classification), or global synchronization; candidate solutions are identified by genetic algorithms. We find that the capacity to solve these computational tasks is preserved, and often improved, under dynamical delays, and the evolved strategies are compared to their "conventional" counterparts.

DY 34.38 Mo 15:30 Poster TU D

Length scales of vectorial solitons and hexagonal patterns in a single-mirror feedback arrangement — •Jens-Uwe Schurek, Matthias Pesch, Thorsten Ackemann, and Wulfhard Lange — Institut für Angewandte Physik, Westfälische Wilhelms-Universität Münster, 48149 Münster

In this report, we consider dissipative vectorial spatial solitons in a simple nonlinear optical system that uses sodium vapor as the nonlinear medium. For low input powers, we observe a symmetry-breaking pitchfork bifurcation between two homogeneous states of different polarization of the transmitted light field. At higher powers, each of these states becomes unstable against a modulational instability leading to a hexagonal pattern with small amplitude.

In this parameter region we observe four types of high-amplitude spatial solitons that differ from each other in size and in the number of radial oscillations. We show that the spatial frequency of these oscillations is connected to the underlying modulational instability though the solitons cannot be interpreted as a constituent of the pattern. The influence of the modulational instability on the distances between simultaneously existing solitons is discussed.

DY 34.39 Mo 15:30 Poster TU D

Localisation At Resonance — •Oliver Strebel — Handjerystr. 31, 12159 Berlin

In nonlinear Hamiltonian systems with two degrees of freedom resonances occur, when the frequencies of the constituting subsystems are integer multiples of each other. In perturbation theories this circumstance gives rise to the famous small denominators of Poincare [1]. At resonance however averaging methods yield reasonable results [2].

In this contribution numerical data are studied at resonance in position coordinates and are compared to analytical approximations. They show a clear localisation of the trajectory in the sense that the trajectory covers

only a small fraction of the position coordinates, which are accessible under the restriction of energy conservation. Shifting away from resonance more and more position coordinates are reached by the trajectory. The results are discussed within the framework of the Poincare-Birkhoff theorem [1].

[1] A.J. Lichtenberg and M.A. Lieberman, Regular and chaotic dynamics, 2nd ed., Springer Berlin AMS 38 (1992).
[2] V.M. Volosov, Russ. Math. Surveys, 17, 1, (1963).

DY 34.40 Mo 15:30 Poster TU D

Modellierung von Anschlussstellen in Zellularautomaten-Modellen — •Florian Mazur und Michael Schreckenberg — Universität Duisburg-Essen, Physik von Transport und Verkehr, Lotharstr. 1, 47057 Duisburg

Mit den gängigen Verkehrssimulationsmodellen ist es nicht möglich, Auffahrten hinreichend realitätsnah zu modellieren. Dabei nimmt man zum Beispiel an, dass möglichst rasch und damit mit niedriger Geschwindigkeit auf die Hauptfahrbahn gewechselt wird. Eine andere Annahme ist, dass die Fahrzeuge möglichst lange auf der Beschleunigungsspur bleiben. Dadurch reduziert sich jedoch der Bereich, in dem der Spurwechsel vollzogen werden kann. Der entwickelte Ansatz teilt die Beschleunigungsspur in drei Abschnitte ein. Jeder Abschnitt hat eine besondere Funktion. Diese sind das Beschleunigen, das Orientieren und der Spurwechsel. Die neuen Regeln sind in der Lage, alle Phasen des Verkehrsflusses an Auffahrten realitätsnah nachzubilden, wie anhand entsprechender Daten mittels Videoaufnahmen verifiziert werden konnte. Daher eignet sich das neue Modell für die Dynamik an Auffahrten, der Drei-Abschnitts-Ansatz, gut für Simulationen wie die des Autobahn-Verkehrs in Nordrhein-Westfalen, welche auf einem weiteren Poster präsentiert wird.

DY 34.41 Mo 15:30 Poster TU D

Nonlinear Dynamics of a Hysteretic Transducer with Nonlocal Memory — •Sven Schubert and Günter Radons — Theoretische Physik I, Complex Systems and Nonlinear Dynamics, TU-Chemnitz

Many physical and technical systems such as shape memory alloys or certain friction models are characterized by a non-trivial hysteretic behavior with complicated subloop structure.

We study input-output-relationships and statistical properties of the system memory for a hysteretic transducer with non-local memory - represented by the Preisach operator. Our interests are input scenarios with chaotic or fractal behavior. Methods taken from time series analysis are used to compare structural properties of the input and output signal. We investigate the influence of different hysteretic nonlinearities generated by the same phenomenological model structure.

DY 34.42 Mo 15:30 Poster TU D

Self-organised pattern formation upon femtosecond laser ablation: circular polarisation — •Olga Varlamova[1,2], Florenta Costache[1,2], Michael Bestehorn[1], and Jürgen Reif[1,2] — [1]Brandenburgische Technische Universität Cottbus — [2]IHP/BTU JointLab

Upon multi-shot femtosecond laser ablation from different materials, self-organised regular patterns are observed at the crater bottom. For linearly polarised excitation, it has been shown that long periodic ripples develop, the orientation of which is determined by the polarisation direction, though the fundamental nature of this correlation is not yet known.

To investigate this phenomenon closer, we performed corresponding experiments using circularly polarised light. Scanning-Electron and Atomic-Force microscopy reveal that, again, a variety of self-organised patterns is obtained, from bead-string and skin-like structures to bifurcating longer lines. The orientation of these lines, however, is random and varies between different spots. First attempts are made to model this behaviour.

DY 34.43 Mo 15:30 Poster TU D

Synchronization of rotating helices by hydrodynamic interactions — •Michael Reichert and Holger Stark — Universität Konstanz, Fachbereich Physik, D-78457 Konstanz, Germany

Some types of bacteria use rotating helical flagella to swim. The motion of such organisms takes place in the regime of low Reynolds numbers where viscous effects dominate and where the dynamics is governed by hydrodynamic interactions. Typically, rotating flagella form bundles, which means that their rotations are synchronized. The aim of our study is to investigate whether hydrodynamic interactions can be at the origin of such a synchronization.

We consider two stiff helices that are modelled by rigidly connected beads, neglecting any elastic deformations. They are driven by constant and equal torques, and they are fixed in space by anchoring their terminal beads in harmonic traps. We observe that, for finite trap strength, hydrodynamic interactions do indeed synchronize the helix rotations. The speed of phase synchronization decreases with increasing trap stiffness. In the limit of infinite trap stiffness, the speed is zero and the helices do not synchronize. This limit is consistent with recent work by Kim and Powers based on slender-body theory [Phys. Rev. E **69**, 061910 (2004)].

DY 34.44 Mo 15:30 Poster TU D

Synchronization of spiral wave motion by spatio-temporal forcing — •Sergey Zykov[1], Harald Engel[2], Vladimir Zykov[2], and Vasilij Davydov[1] — [1]Moscow Institut of Radioengineering, Electronics and Automation, Russia — [2]Institut für Theoretische Physik, Technische Universität Berlin, Germany

A traditional way to control spiral wave motion is to apply an external forcing uniformly to an excitable medium. Here we consider spiral waves in a two-dimensional excitable medium under a spatio-temporal forcing $F(x, y, t) = a \sin(\omega_m t + k_m x)$, assuming that $k_m r_0 \ll 1$, where r_0 is the radius of the spiral core. We show, that within a certain synchronization band such forcing induces a spiral wave drift along a straight line, whose orientation depends on the modulation frequency ω_m, wavenumber k_m and the eigen frequency of the spiral wave. It turns out that during this drift the phase of the rotating spiral wave is synchronized with the external forcing. Kinematical description of spiral tip motion is in good agreement with the results of a direct integration of the underlying reaction-diffusion equations.

DY 34.45 Mo 15:30 Poster TU D

Time-evolution of the Rule 150 cellular automaton activity from a Fibonacci iteration — •Jens Christian Claussen — Theoretical Physics, University Kiel

The total activity of the single-seeded cellular rule 150 automaton does not follow a one-step iteration like other elementary cellular automata, but can be solved as a two-step vectorial, or string, iteration, which can be viewed as a generalization of Fibonacci iteration generating the time series from a sequence of vectors of increasing length [1]. This allows to compute the total activity time series more efficiently than by simulating the whole spatio-temporal process, or even by using the closed expression.

[1] J. C. Claussen, arXiv.org math/0410429

DY 34.46 Mo 15:30 Poster TU D

Torusverdopplung in einem Serienschwingkreis mit nichtlinearer MOS-Struktur — •Martin Diestelhorst[1], Bogdan Mereu[2] und Marin Alexe[2] — [1]Martin-Luther-Universität Halle-Wittenberg, Fachbereich Physik, Friedemann-Bach-Platz 6, 06108 Halle — [2]Max-Planck-Institut für Mikrostrukturphysik, Weinberg 2, 06120 Halle

In einem Serienschwingkreis wurde neben einer linearen Luftspule als nichtlineare Kapazität eine Metall-Ferroelektrikum-p-Silizium-Schichtstruktur verwendet. Als Ferroelektrikum diente dabei eine $Bi_4Ti_3O_{12}$-Schicht von 300 nm Dicke. Das System zeigte eine Reihe von Periodenverdopplungskaskaden bei Variation von Amplitude und Frequenz der Anregungsspannung. Weiterhin wurden im System in einem Amplituden-Frequenz-Gebiet der Anregungsspannung Torusverdopplungen beobachtet. Die Ergebnisse werden auf der Grundlage eines modifizierten Modells einer MOS-Kapazität mit ferroelektrischem Dielektrikum interpretiert.

DY 34.47 Mo 15:30 Poster TU D

Dissipative Solitons in Planar Gas-Discharge Systems — •Hendrik U. Bödeker[1], Andreas W. Liehr[1,2], and Hans-Georg Purwins[1] — [1]Institut für Angewandte Physik, WWU Münster, Corrensstr. 2/4, 48149 Münster — [2]Freiburger Materialforschungszentrum, Stefan-Meier-Str. 21, 79104 Freiburg

Dissipative solitons (DSs) are self-organized structures in nonlinear dissipative systems with particle-like properties. They are known to exist in many different circumstances. DSs can be investigated in an exemplary manner in planar gas-discharge systems. On this poster, we give an overview of experimental observations. Among other things we observed propagation, scattering, formation of molecules, generation and annihilation. In case that the number of DSs is preserved, properties of DSs can be analyzed using stochastic data analysis. The basic mechanisms of

the formation and the dynamics of DSs can be understood in terms of reaction-diffusion models that can be connected to microscopic models by adiabatically eliminating the fast time-scales in the system.

DY 34.48 Mo 15:30 Poster TU D

Playing with quantum walks — •Jochen Endrejat and Helmut Büttner — Theoretische Physik I, Universitaet Bayreuth, 95440 Bayreuth

We are simulating stroboscopic quantum walks with history dependence. This quantum system shows various phenomena from quantum game theory on the one hand and from quantum chaos on the other hand. We will report on results for different parameter values.

DY 34.49 Mo 15:30 Poster TU D

Quantum Chaos Experiments with Microwave Billiards — •F. Schäfer, B. Dietz, T. Friedrich, H.-D. Gräf, A. Heine, and A. Richter — TU Darmstadt, Institut für Kernphysik, Schlossgartenstr. 9, 64289 Darmstadt

We present experiments with normal conducting as well as with superconducting microwave resonators.

With the help of different experimental setups eigenfunctions and eigenvalues of arbitrarily shaped cavities can be measured. Due to an isomorphy between the Schroedinger equation and the Helmholtz equation describing two-dimensional electromagnetic resonantors, these investigations give insight to quantum chaotic phenomena. In experiments with normal conducting resonators at room temperature we address – among other aspects – effects connected with the breaking of time-reversal symmetry.

This work is supported by DFG within SFB 634.

DY 34.50 Mo 15:30 Poster TU D

Bifurcation in kinetic equation for interacting Fermi systems — K. Morawetz — Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany

The nonlocal quantum kinetic equation for dense interacting Fermi systems [1,2] combines time derivatives with finite time stepping known from the logistic mapping [3]. This continuous delay differential equation equation is a consequence of the microscopic delay time representing the dynamics of the deterministic chaotic system. The responsible delay time is explicitly calculated and discussed for short range correlations. As a novel feature oscillations in the time evolution of the distribution function itself appear and bifurcations up to chaotic behavior occur [3]. The temperature and density conditions are presented where such oscillations and bifurcations arise indicating an onset of phase transition.

[1] P. Lipavský, K. Morawetz, and V. Špička; Annales de Physique, Paris, 2001, No. 26, 1, ISBN 2-86883-541-4
[2] K. Morawetz, P. Lipavsk'y, V. Spicka; Ann. Phys. 294 (2001) 135
[3] K. Morawetz; CHAOS 13 (2003) 572

DY 34.51 Mo 15:30 Poster TU D

Shear-driven flocculation of sticky spheres: crossover from kinetic aggregation to anisotropic percolation — •Kajetan Bentele[1], Klaus Kroy[1], and Hans Herrmann[2] — [1]Hahn-Meitner Institut Berlin — [2]Universität Stuttgart

Recent advances in mode-coupling theory have lead to substantial progress in our understanding of the complex non-equilibrium phase behavior of dense, weakly adhesive hard spheres and the shear-melting of their kinetically arrested states. The situation at low densities, high shear rates and stronger attractions is still very controversial and various universal jamming "phase diagrams"have been proposed. We report numerical studies of a simple, highly idealized, 2-dimensional adhesive-hard-sphere fluid under shear. Although temperature effects and hydrodynamic interactions are (so far) neglected, we expect the simulation to be indicative of the anisotropic large-scale properties of strongly sheared flocculating colloids. In particular, these approximations allow us to derive a simple but efficient analytical expression for the gel time that accounts for the structural crossover from kinetic aggregation to (anisotropic) percolation. A modified Flory argument further elucidates the crossover mechanism.

DY 34.52 Mo 15:30 Poster TU D

A parallel cluster algorithm applied to model DNA systems — •Jakob Schluttig[1] and Godehard Sutmann[2] — [1]Institut für Theoretische Physik, Universität Leipzig, Germany — [2]Zentralinstitut für Angewandte Mathematik, John von Neumann Institut für Computing, Forschungszentrum Jülich, Germany

The aim of this work was to build the basis for a parallel Monte Carlo cluster algorithm for continuous two-dimensional spin systems. A purely geometrical technique for searching clusters was developed. It is capable of being extended to an energetic cluster criterion, which is the basis in Monte Carlo cluster methods. The scaling of the implementation was measured and analyzed. Finally it was applied to model DNA systems [1] simulated with "$SpinCG^{2d}$" [2] using the Kornyshev-Leikin [3] potential. Geometric clusters were studied as a function of different DNA characteristics, e.g. the charge compensation parameter θ.

[1] H. M. Harreis, A. A. Kornyshev, C. N. Likos, H. Löwen, G. Sutmann, Phys. Rev. Lett. **89**, 018303-1 (2002)
[2] G. Sutmann, *$SpinCG^{2d}$ - a parallel Monte Carlo program for spin systems*, in preparation
[3] A. A. Kornyshev, S. Leikin, J. Chem. Phys. **107**, 3656 (1997)

DY 34.53 Mo 15:30 Poster TU D

Computer simulation studies of model colloids in equilibrium and non-equilibrium — •Peter Henseler and Peter Nielaba — Lehrstuhl für Theoretische Physik, Fachbereich Physik, Universität Konstanz, D-78457 Konstanz

We perform classical Monte-Carlo simulations in the NVT ensemble to calculate isothermal elastic constants of crystal phases of hard-sphere systems [1]. The elastic constants are determined in a single simulation run from microscopic fluctuations of the instantaneous local Lagrangian strain tensor and the use of a finite-size scaling theory. This approach is a generalization of the method of Sengupta *et al.* [2] to three dimensions. We will discuss the importance of finite size effects. The outlined approach also allows us to study the effect of impurities on the elastic properties. On the other hand we study the non-equilibrium behavior of colloids flowing in a micro channel driven by the gravitational field. We perform Molecular Dynamics simulations with a Nosé-Hoover thermostat to study the occuring structures and flow rate behavior in dependence of the inclination angle of the micro channel and the mean particle density in the channel.

[1] P. Nielaba, K. Binder, D. Chaudhuri, K. Franzrahe, P. Henseler, A. Ricci, S. Sengupta, W. Strepp J. Phys: Cond. Matt. **16** No 38, S4115 (2004)
[2] S. Sengupta, P. Nielaba, M. Rao, K. Binder, Phys. Rev. **E 61**, 1072 (2000)

DY 34.54 Mo 15:30 Poster TU D

Depletion forces in colloidal systems — •Jules Mikhael, Laurent Helden, and Clemens Bechinger — 2. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, 70550 Stuttgart, Germany.

The stability and phase behavior of colloidal suspensions containing particles of different size and shape is known to be strongly influenced by depletion forces. Various kinds of colloids as for example spheres, rod- and disc-like Particles or polymeres can serve as depletion agent. The depletion forces they induce can lead even in systems where all pair interactions are purely repulsive to attractive forces which may finally cause particle flocculation. Accordingly, the understanding of these forces is besides fundamental interest also essential for industrial processes. The technique of total internal reflection microscopy (TIRM) is capable to measure these weak depletion interactions with a force resolution in the order of 10 fN. Here we present direct measurements of depletion potentials between a sphere and a flat surface caused by various depletion agents.

DY 34.55 Mo 15:30 Poster TU D

Laser-Induced Freezing in 2D in Incommensurate Potentials — •Christine Kircher, Wolfram Strepp, and Peter Nielaba — Physics Department, University of Konstanz, Fach M692, 78457 Konstanz, Germany

Since the 1980s there is an ongoing experimental and theoretical research in the phenomena of laser-induced freezing and melting in 2D colloidal systems. The phase diagrams of such systems contain phase transitions from a modulated liquid to a triangular solid when a periodic external commensurate potential is applied.

We concentrated our work on the influence of external periodic incom-

mensurate potentials on 2D systems. Incommensurate means that the potential wavelength is not any longer a multiple integer of the lattice constant of the triangular solid. Incommensurate potentials with smaller respectively larger wavelengths compared to the commensurate wavelength were applied to a hard disk system. A variety of different new phases was discovered. We concentrated our research on one new solid phase distinct from the typical triangular solid. Using finite size analysis of the order parameter and its cumulants for a constant wavelength $\lambda^* = 0.6558$ ($= \lambda/\sigma$; σ = particle diameter) the phase transition was determined.

[1] W. Strepp, S. Sengupta, and P. Nielaba, Phys. Rev. E **63**, 046106 (2001)
[2] W. Strepp, S. Sengupta, and P. Nielaba, Phys. Rev. E **66**, 056109 (2002)
[3] C. Kircher, diploma thesis, (2004)

DY 34.56 Mo 15:30 Poster TU D

Light Transport in Foams — •Michael Schmiedeberg and Holger Stark — Universitaet Konstanz, Fachbereich Physik, M621, 78457 Konstanz

Recent light-scattering experiments on foams suggest that the light transport is diffusive. This means that single photons can be considered as random walkers. In our studies, we construct two-dimensional Voronoi foams and replace the edges of the cells by channels of finite width to represent the liquid films. Based on geometrical ray optics, we then investigate how light propagates through a foam by using random walk theories and simulations.

Experiments by Durian *et al.* show that light possesses a higher probability to propagate in the liquid films. To model the extrem case of such a *photon channeling*, we first assume that all photons are completely reflected at each liquid-air interface so that they only move within the films. Then we relax this constraint and introduce reflection and transmission probabilities according to Fresnel's formulas. In both cases, simulations of the photons' random walk in a perfect honeycomb structure reveal superdiffusive behavior which we also explain within the theory of Lévy walks. In disordered lattices, light transport is, however, diffusive and depends strongly on the amount of disorder.

DY 34.57 Mo 15:30 Poster TU D

Mode-coupling theory for a Lorentz gas with orientational degree of freedom — •Felix Höfling, Erwin Frey, and Thomas Franosch — Hahn-Meitner-Institut, Glienicker Str. 100, 14109 Berlin

In this poster, we address the question of how a semiflexible polymer moves in a network of semiflexible polymers. We concentrate on a simplified model that is based on the two-dimensional Lorentz gas: instead of a structureless particle a needle moves through a random but fixed array of spherical obstacles. This implies that the original Lorentz model is enriched not only by a orientational degree of freedom but also by an additional length scale. Therefore, the phase diagram of the system depends on two parameters, e.g. the obstacle density and the length of the needle. It shows a critical line which separates an ergodic regime from a non-ergodic one. Above this line, the needle is trapped in the medium. Using a mode-coupling approximation, we obtain closed equations for the relevant correlation functions of the system. The theory is solved numerically in order to yield the phase diagram, non-ergodicity parameters and diffusion coefficients.

DY 34.58 Mo 15:30 Poster TU D

Phase transitions of model colloids and quantum disks in external potentials — Wolfram Strepp[1], Surajit Sengupta[2], and •Peter Nielaba[1] — [1]Physics Department, University of Konstanz, Fach M691, 78457 Konstanz, Germany — [2]S.N. Bose National Centre for Basic Sciences, Block JD, Sector III, Salt Lake, Calcutta 700098, India

Systems of model colloids in a spatially periodic external potential show rich phase diagrams, including laser-induced freezing (LIF) and melting (LIM). We use finite size scaling analyses of the order parameter and its cumulants in order to map the phase diagrams, from which the width of the freezing- and reentrance region is calculated. The effect of the finite particle mass on the phase diagram is computed by path integral Monte Carlo (PIMC). Qualitatively new features like the direct "quantum melting" from an ordered solid structure to a modulated liquid by increasing external field amplitude are predicted, in contrast to the behaviour of purely classical systems.

DY 34.59 Mo 15:30 Poster TU D

Simulation of Peloids — •Martin Hecht[1], Jens Harting[1], Thomas Ihle[2] und Hans J. Herrmann[1] — [1]ICP, University of Stuttgart, Pfaffenwaldring 27, 70569 Stuttgart, Germany — [2]North Dakota State University, Department of Physics, Box 5566, Fargo, ND 58105-5566

We are investigating properties of dense suspensions and sediments of small spherical clay particles by means of a combined molecular dynamics (MD) and Stochastic Rotation Dynamics (SRD) simulation. We include electrostatic and van der Waals interaction between the colloid particles, as well as Brownian motion and hydrodynamic interactions which are calculated in the SRD-part.

We present the simulation technique and first results. We have measured velocity distributions, diffusion coefficients, sedimentation velocity, spacial correlation functions and we have explored the phase diagram depending on the parameters of the potentials and volume fraction.

DY 34.60 Mo 15:30 Poster TU D

Simulation of the localisation transition of the Lorentz gas — •Felix Höfling, Erwin Frey, and Thomas Franosch — Hahn-Meitner-Institut, Glienicker Str. 100, 14109 Berlin

The Lorentz model for transport in disordered media describes a structureless, classical particle moving through a random array of fixed spherical obstacles. It exhibits a localisation transition, i.e. above a certain density, the particle is trapped in the medium and the system becomes non-ergodic. Although this transition is related to the liquid-glass transition, a divergent length scale is present in the Lorentz model. This transition has been characterised theoretically by mode-coupling theory (MCT).

We have carried out computer simulations of the Lorentz gas at obstacle densities close to the critical point, such that the diffusion coefficient is suppressed by five orders of magnitude. Therefore, it becomes possible to determine the critical density and critical exponents. Our results indicate that the transition is compatible with the underlying problem of continuum percolation as conjectured in the literature. Furthermore, when approaching the critical point, we observe the opening of a time window where the particle shows subdiffusive behaviour—in agreement with the theoretical predictions of MCT.

DY 34.61 Mo 15:30 Poster TU D

Structural and elastic properties of two-dimensional model colloidal crystals: Monte-Carlo Simulations — •Kerstin Franzrahe and Peter Nielaba — Department of Physics, University of Konstanz, 78457 Konstanz, Germany

Structural and elastic properties of solids are of great interest for the design of soft materials. Monte-Carlo simulations are an effective means for a systematic analysis of these properties. Our main interest is in the behaviour of two-dimensional model colloidal crystals. As a model system we chose the hard disk system. Structural insight can be gained by finite-size-scaling analysis of suitable order parameters, while elastic properties can be studied using so called 'fluctuation' methods. We implemented a method by S. Sengupta et.al [1], which enables us to extract the elastic constants of the infinite system from microscopic fluctuations of the Lagrangian strain tensor ϵ_{ij} by making use of a block analysis procedure. The elastic constants of binary mixtures were thus determined via simulations in the NVT ensemble. Simulations in the NPT ensemble were done in order to analyse lattice formation in binary mixtures. In addition we analysed the influence of quenched impurities on the elastic properties of a mono-disperse hard disk system [2].

[1] S. Sengupta, P. Nielaba, M. Rao, K. Binder Phys. Rev. E 61,1072 (2000)
[2] P. Nielaba, K. Binder, D. Chaudhuri, K. Franzrahe, P. Henseler, A. Ricci, S. Sengupta, W. Strepp, J. Phys.: Condens. Matter 16 (2004) S4115-S4136

DY 34.62 Mo 15:30 Poster TU D

Universal properties of complexes formed by oppositely charged flexible polyelectrolytes — •Roland G. Winkler — IFF, Forschungszentrum Jülich, D-52425 Jülich

Results of molecular dynamics simulations for systems with two flexible, oppositely charged polymer chains are presented. It is shown that the chains aggregate into densely packed structures. The universal properties of the formed complexes are investigated as a function of chain length and interaction strength. For weakly interacting systems, a chain length depended effective interaction strength is obtained which governs the initiation of the aggregation process. At intermediate interaction strengths,

the formed complexes exhibit a scaling behavior with respect to molecular weight typically for chain molecules in a bad solvent. An unusual weak dependence of the radius of gyration on the interaction strength is found in this regime. Finally, for strong interactions tightly packed globules are obtained. The radii of gyration and the densities of the complexes are discussed.

DY 34.63 Mo 15:30 Poster TU D

Coarse-Grained Polymer Models: On-Lattice vs. Off-Lattice — •Thomas Vogel, Michael Bachmann, and Wolfhard Janke — Institut für Theoretische Physik, Universität Leipzig, Augustusplatz 10/11, 04109 Leipzig, Germany

We investigated coarse-grained polymer models such as the HP on-lattice and the AB off-lattice formulations for heteropolymers ("proteins"). The poster will focus on the results of two problems.

Firstly, we will give results of investigations concerning *designing sequences* in the HP model on lattices. To this end we perform exact enumerations of the whole sequence-conformation space of HP proteins on the fcc lattice up to a certain chain length and compare with results from the simple cubic lattice.

Secondly we try to show how "far" lattice models are from "reality", or from similar off-lattice models, respectively. Therefore we simulate off-lattice AB model-like proteins with different potentials and compare putative ground states with those from on-lattice simulations.

DY 34.64 Mo 15:30 Poster TU D

Nonlinear dynamics of stiff polymers — •Benedikt Obermayer[1], Erwin Frey[1,2], Klaus Kroy[1], and Oskar Hallatschek[1] — [1]Abteilung Theorie, Hahn-Meitner Institut, Glienicker Str. 100, 14109 Berlin, Germany — [2]Fachbereich Physik, Freie Universität,14195 Berlin, Germany

We have theoretically analyzed the anisotropic (non)linear dynamic response of stiff polymers to external driving fields. A general (time–dependent) criterion is given for the crossover from a universal linear to a nonlinear regime, the latter depending on the type of the driving. Asymptotic scaling laws are extracted from a set of coarse grained equations of motion obtained from a rigorous multiple scale analysis. To determine the precise behavior of a polymer in non–asymptotic and/or mixed scenarios occurring in vitro and in vivo, an efficient numerical algorithm has been developed which solves the corresponding partial integro differential equations.

DY 34.65 Mo 15:30 Poster TU D

3D-Simulationen im Phasenfeld-Modell — •Martin Ohlerich — BTU Cottbus, LS Theoretische Physik II, Erich-Weinert Str. 1, 03046, Cottbus

Betrachtet wird ein Zwei-Schicht-System aus Flüssigkeit und Gas über einem geheizten Substrat. Ein stetiges Feld, das Phasenfeld, indiziert in den Volumenelementen den Phasenzustand der Flüssigkeit. Da dieses Feld stetig ist, ist die freie Oberfläche zwischen Gas und Flüssigkeit nicht mehr scharf (Fläche), sondern das Phasenfeld fällt über eine gewisse Länge kontinuierlich ab (Oberfläche $\hat{=} Volumen$). Dadurch muß man die Randbedingungen an dieser Oberfläche nicht mehr explizit hinzufügen, da diese implizit in den stetigen Änderungen der Dichte enthalten sind. Betrachtet wird außerdem eine Temperatur-abhängige Oberflächenspannung, die zu Instabilität der glatten Oberfläche führen kann. Untersuch wird die Bildung von Strukturen durch diesen Mechanismus in diesem Phasenfeld-Modell.

DY 34.66 Mo 15:30 Poster TU D

Experimental investigation of Rayleigh-Bénard convection in cells of aspect ratio one — •Janet Neerken, Joachim Peinke, Achim Kittel, and Marco Munzel — Carl-von-Ossietzky Universität Oldenburg

We present experimental results of turbulent Rayleigh-Bénard convection in water in cells of aspect ratio one. The Rayleigh numbers in our experiments are up to $7 \cdot 10^9$. With different experimental methods we measure the flow structures close to the bottom or top plate. The aim of our work is to investigate the stability of the large-scale circulation and how this may be affected by the geometry of the Rayleigh-Bénard cell. Therefore we compare results from a cylindrical and a quadratic cell.

DY 34.67 Mo 15:30 Poster TU D

Lagrangian particle statistics in two dimensional turbulence — •Susanne Zeglin and Rudolf Friedrich — Institut für Theoretische Physik, Universität Münster, Wilhelm-Klemm-Str. 9, 48149 Münster

Based on a numerical solution of the forced Navier-Stokes equation we present results on the statistics of Lagrangian particles for two dimensional turbulence. Special emphasis is placed on the properties of particle acceleration. We show that the probabiliy distribution of the particle acceleration can be well approximated by streched exponentials. A comparison with the results on the basis of a point vortex model for twodimensional turbulence is made.

DY 34.68 Mo 15:30 Poster TU D

Lorenz-like Equations for the Taylor-Couette System — •Hans-Reinhard Berger — Technische Universität Chemnitz, Institut für Physik

The influence of elasticity on the flow between rotating cylinders is examined by a low-dimensional truncated expansion of trigonometric modes. The viscoelastic second-order model is used in order to describe the material properties of the fluid.

The resulting system of ordinary differential equations describes well the transitions from laminar Couette flow to Taylor-vortex flow, but no bifurcations towards more complex flow structures are observed. It is found that elasticity has a destabilizing influence on the laminar flow compared with the pure viscous flow.

The results of the stability analysis of the truncated system are compared with linear stability calculations of the original hydrodynamic and constitutive equations. The deviations are within a few percent.

DY 34.69 Mo 15:30 Poster TU D

Particle diffusion in fluid flow — •Michael Schindler, Peter Talkner, Marcin Kostur, and Peter Hänggi — Theoretische Physik I, Institut für Physik, Universität Augsburg

We present results showing the diffusive transport of advected particles in a fluid flow field. Such behaviour is important e.g. for large molecules in biological cells but also in more technical applications like "planar fluidics" [1] on partially wetting substrates. The drift term in the corresponding Fokker-Planck equation is taken to be a solenoidal velocity field given as the solution of the stationary Stokes equation. In order to find non-trivial distributions of the particle's position in the fluid we have to embed into the Fokker-Planck equation the fact that the particles are of finite size. The boundary conditions of the Stokes equation are determined by the considered systems. Especially in the limit of small fluid domains the strong surface tension at free surfaces dominates the functional form of the velocity field.

[1] Z. Guttenberg *et al.*, *Flow profiling of a surface acoustic wave nanopump*, Phys. Rev. E **70**, xxxxx (2004) in press; arxiv:cond-mat/0405199.

DY 34.70 Mo 15:30 Poster TU D

Pattern formation and regularized phase equation — •Nicole Rinke and Rudolf Friedrich — Institut für Theoretische Physik, Wesftälische Wilhelms-Universität, Wilhelm-Klemm-Str. 9, 48149 Münster, Germany

The phase equation of Cross and Newell [1] is used to study long wavelength instabilities in pattern forming systems like Rayleigh Bénard convection. Recently, a regularized version of this equation has been considered by Ercolani and Newell [2], which also allows the description of defects. We shall present results of a numerical investigation of these equations and discuss possible implications for a geometric description of patterns in nonequilibrium systems. [1] M.C. Cross and P.C. Hohenberg, Rev. Mod. Phys., Vol. 65, No.3 (1993) [2] N.M. Ercolani, R. Indik, A.C. Newell and T. Passot, J. Nonlinear Sci. Vol.10 (2000)

DY 34.71 Mo 15:30 Poster TU D

Roll drift within a localized electroconvection pattern — •Dan Spiegel — Trinity University (USA)

We have found that a locally supercritical electroconvection region can be generated in a nematic liquid crystal (MBBA) by an absorbed laser beam. If a cylindrical lens is used to extend the laser cross-section into a high-aspect-ratio rectangle with the long side parallel to the director, then the locally supercritical region is essentially one dimensional. In contrast to traditional MBBA electroconvection patterns with spatially extended rolls, the localized rolls drift with frequencies on the order of 0.1 Hz. The drift frequency displays a quadratic dependence on the voltage across the

sample if both the amplitude and frequency of the applied voltage are increased in a manner that keeps the pattern amplitude constant. We will discuss a possible model for these dynamics based on a Ginzburg-Landau equation in which the parameters are functions of position.

DY 34.72 Mo 15:30 Poster TU D

Self-excited drop oscillations in electrowetting experiments — •Jean-Christophe Baret[1] und Frieder Mugele[2] — [1]Philips Research, Eindhoven (NL) — [2]University of Twente, Physics of Complex Fluids; 7500 AE Enschede (NL)

In electrowetting experiments the contact angle of a droplet on a substrate is modified by an external voltage applied between an electrode immersed in the drop and a substrate coated with an insulating layer. When the electrode is barely immersed into the droplet, a capillary neck develops between the droplet and the electrode upon applying a voltage. At a certain threshold voltage, the capillary neck breaks.
Working with AC voltage U at frequency f from 1 to 30 kHz, and electrical conductivity of the drop from 0.1 to 10 mS/cm, two regimes have been observed above the critical voltage: A regime of fast and regular oscillations of the drop (10-120 Hz) at high frequency f or low conductivity and a regime of eratic and slow oscillations at low frequency f or high conductivity.

The difference in the two regimes is explained by a simple electrical model based on the divergence of the resistance of capillary neck at the break-up $r(t) = r_0(t/t^*)^\gamma$, r_0 being representing the conductivity of the drop. From this analysis an dimensionless number $A = 2\pi r_0 C \nu^{\gamma+1} t^{*\gamma}$ is defined , C being the capacitance of the drop. For $A >> 1$, the charge kept in the drop after the break up is 0 which explains that the relaxation of the drop is purely hydrodynamical leading to regular oscillations, while for $A << 1$ the charge is randomly disctributed between 0 and CU explaining the eratic behavior.

DY 34.73 Mo 15:30 Poster TU D

Solitäre Wellen auf Ferrofluiden — •Dirk Rannacher — Fakultät V, Carl-von-Ossietzky Universität Oldenburg, 26111 Oldenburg

Wellenpakete, die sich ohne Verlust ihrer Form ausbreiten, heißen Solitonen. Diese entstehen durch das geschickte Zusammenspiel zwischen Nichtlinearität und Dispersion. Für, im Vergleich zur Tiefe der Flüssigkeit, kleine Amplitude und großer Wellenlänge, werden Solitonen durch die Korteweg de Vries Gleichung beschrieben.
Ferrofluide sind spezielle Flüssigkeiten, die auf Magnetfelder reagieren. Aus den daraus resultierenden hydrodynamischen sowie elektrodynamischen Gleichungen leiten wir eine Korteweg de Vries Geleichung ab. Dabei gehen wir von einem magnetischen Gradientenfeld aus.

DY 34.74 Mo 15:30 Poster TU D

Statistik der Temperaturfluktuationen als passiver Skalar im Freistrahlexperiment — •Marco Munzel und Achim Kittel — Carl von Ossietzky Universität Oldenburg, Institut für Physik, 26111 Oldenburg

Es werden Messungen vorgestellt, die mit einem von uns neu entwickelten, schnellen Thermosensor durchgeführt wurden. Dieser Sensor hat eine aktive Fläche von ca. 0.05 μm^2, eine Ansprechzeit von ca. 10 μs in Wasser bei einer Temperaturauflösung von 50mK (gemessen mit einer Bandbreite von 100kHz). Mit diesem Sensor wurden Messungen in einem angewärmten Freistrahl (Wasser in Wasser) bei unterschiedlichen Sensorpositionen und Strömungsgeschwindigkeiten an der 2mm messenden Düse durchgeführt, die eine laminare Strömung mit rechteckigem Geschwindigkeitsprofil gewährleistet. Präsentiert werden Untersuchungen zur Ortsabhängigkeit der Leistungsspektren und der Inkrementverteilungen von Temperaturfluktuationen senkrecht und parallel zum Freistrahl.

DY 34.75 Mo 15:30 Poster TU D

Strömungsuntersuchung an schwingenden Wassertropfen — •Frank Rietz — Otto-von-Guericke Universität Magdeburg, Institut für Experimentelle Physik, Abteilung Biophysik

Wird etwas Wasser auf eine genügend heiße Kochplatte gegeben, bildet sich ein Tropfen, der auf seinem eigenen Dampffilm schwebt (Leidenfrost-Effekt). Der Tropfen schwingt dabei in verschiedenen sternförmigen Mustern. Dieses Phänomen wird seit den 1950er Jahren erforscht. Nicht experimentell untersucht wurden bisher die inneren Strömungsverhältnisse. Mit Particle Image Velocimetry (PIV) und einer neuartigen Hochgeschwindigkeitskamera wurde versucht das Strömungsfeld zu bestimmen. Es konnten Korrelationen zwischen der äußeren Verformung und dem Strömungsfeld festgestellt werden. Nähere Informationen gibt es unter: http://iep463.nat.uni-magdeburg.de/w3fr/welcome.html

DY 34.76 Mo 15:30 Poster TU D

Striations in Kundt's tube filled with water — •A. Langenbucher, C.A. Krülle, and I. Rehberg — Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth

Kundt's tube is a well-known device for demonstrating standing sound waves where dust particles assemble at the nodal lines. In between, the accumulation of dust is not homogeneously distributed but shows sharp parallel stripes, which are known as "striations"(E.N. da C. Andrade, Trans. Roy. Soc. A 230, 413 (1932)). Most works on this phenomenon were done with air as driving fluid. Here we report on first results on the hydrodynamic behavior in a water-filled tube, which is exposed to an oscillating flow generated by a vibrating piston. The observed pattern formation is due to the hydrodynamic interaction of a small amount of glass beads with the surrounding fluid.

DY 34.77 Mo 15:30 Poster TU D

Subdiffusion in Random Compressible Flows — •Vasily Zaburdaev[1,2] and Konstantin Chukbar[1] — [1]RRC "Kurchatov Institute", 123182 Moscow, Russia — [2]current affiliation: MPI for Dynamics and Self-Organisation, Bunsenstraße 10, 37073 Göttingen

In this work we study the diffusion of admixture particles in one-dimensional random velocity field given by a gradient of random potential. We start with the description of new approach developed and tested for the problem of anomalous diffusion on comb-like structures. We show that for the case of periodic potential wells with depth b macroscopic transport is diffusive but with exponentially small diffusion coefficient $D_{eff} \propto e^{-b/D}$. For the case of quenched disorder (fixed realization of the random potential relief) system exhibits complex subdiffusive behavior. We find the Green's function for macroscopic density of admixture particles and show that for some particular classes of distributions of potential wells it satisfies subdiffusive equation with fractional derivative with respect to time.

DY 34.78 Mo 15:30 Poster TU D

The break up of capillary bridges of complex liquids — •Rainer Sattler — Universität des Saarlandes, Geb. 38, 3.OG, Pf. 151150, 66041 Saarbrücken

The break up of capillary bridges of complex liquids is investigated first on a falling droplet and second in a capillary break up extensional rheometer (CABER). The latter describes a set up where a small amount of liquid is placed between two plates that are torn apart rapidly. In between a capillary bridge is formed that breaks up after the formation of an elastic filament. Both methods allow a determination of the elongational viscosity. We present conditions for experimental parameters under which both experiments are equivalent or not. The elongational viscosity η_e can be defined similar to the shear viscosity η_s and is given for Newtonian liquids by the so called Trouton ratio $\eta_e/\eta_s = 3$. For polymer solutions this factor can be higher by several orders of magnitude. But experimental data as well as theoretical understanding of the physical mechanisms of these phenomena are still very limited.

DY 34.79 Mo 15:30 Poster TU D

Control of Stochastic Differential Equations in growth phenomena — •Michael Block and Eckehard Schöll — Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin

We solve the stochastic differential equations for crystal growth processes numerically utilizing a forward-backward Euler algorithm. The exponents describing the time-evolution of a surface are the growth exponent, the roughness exponent and the dynamic exponent, where only two are independent.

Concentrating on the evolution we involve simple control mechanisms in a classical way. The influence of different included control forces on the growth exponents and namely the surface roughness is analysed. The differences beetween uncontrolled and controlled growth processes are discussed by comparison in detail.

DY 34.80 Mo 15:30 Poster TU D

Controlling of fractal dimension and symmetry of growing Xenon dendrites — •Marco Fell, Herman M. Singer und Jörg H. Bilgram — Laboratorium für Festkörperphysik, ETH, CH-8093 Zürich, Switzerland

Xenon dendrites, grown in supercooled melt ($\Delta T \sim 100 - 200$ mK), show characteristic sidebranching frequencies depending on supercooling. They are statistically symmetric and the contours' outlines have a characteristic fractal dimension, depending on growth morphology (dendrite, dublon and seaweed) but not on supercooling.

In our experiments we disturb the free growth by heating of the melt. The crystal stops growing or begins to melt, depending on power and duration of heating. After stopping the heating, the liquid xenon cools down and growth restarts. Interestingly four absolutely symmetrical lobes start to grow at the main tip.

Repeating this process is found to lead to a new growth morphology, characterized by a lower fractal dimension, an average curvature of the contour lower than the ones found in other morphologies and a new hidden length scale.

DY 34.81 Mo 15:30 Poster TU D

Defect-Induced Coarsening in Step Flow Growth — •Gerrit Danker[1], Olivier Pierre-Louis[2], Chaouqi Misbah[2], and Klaus Kassner[1] — [1]Institut für Theoretische Physik, Otto-von-Guericke-Universität Magdeburg, PSF 4120, 39016 Magdeburg, Germany — [2]LSP, UJF-Grenoble 1, BP 87, 38402 Saint Martin d'Hères, France

Epitaxial growth on vicinal surfaces is known to lead to the so-called meandering instability: steps become wavy and the crystal surface acquires ripples perpendicular to the step direction. A simple theory which presumes that steps meander in phase predicts that the ripples have a constant lateral width and that their amplitude develops asymptotically like $t^{1/2}$ [1]. However, topological defects which arise early in the instability alter this scenario dramatically. We extend the theory to take phase perturbations into account and show by numerical simulations and simple arguments that the surface is subject to coarsening.

[1] F. Gillet, O. Pierre-Louis, and C. Misbah: Non-linear evolution of step meander during growth of a vicinal surface with no desorption. Eur. Phys. J. B. (2000).

DY 34.82 Mo 15:30 Poster TU D

Interaction Between Dendritic Doublon Tips — •Oliver Wittwer und Jörg Bilgram — Laboratorium für Festkörperphysik, ETH, CH 8093 Zürich, Switzerland

In our experiments we investigate in situ three dimensional pattern formation of xenon crystals during free growth. Well known morphologies are dendrites, dendritic doublons and seaweed. We also observe triplons and quadruplons. The transition from dendrite to dendritic doublon has gained interest since it has been discovered in metallic samples [1]. Transitions between these morphologies can be initiated in our experiments by changing the temperature distribution in the environment of a growing crystal [2].

During the growth of dendritic doublons the two tips are mutually interacting. Three different behaviors induced by this interaction can be observed: 1) Stabilization of the growth velocity of the two tips. 2) Multiple tip splitting. 3) Periodic oscillations in growth velocity where the amplitude is increasing with time. The amplitude is in the range of 20% of tip velocity. These oscillations have to be compared with the growth velocity of a freely growing isolated dendrite where fluctuations in growth rate (mainly due to pixel noise) are below ±1.5% of tip velocity at the same experimental conditions.

[1] K. Dragnevski, R. F. Cochrane, and A. M. Mullis, Phys. Rev. Lett. **89**, 215502 (2002)
[2] I. Stalder and J. H. Bilgram, Europhys. Lett. **56**, 829 (2001)

DY 34.83 Mo 15:30 Poster TU D

Numerical investigation of dendritic growth in external flows — •Dmitry Medvedev and Klaus Kassner — Institute of Theoretical Physics, Otto-von-Guericke University Magdeburg, Universitaetsplatz 2, 39106 Magdeburg

A combined phase-field/lattice-Boltzmann scheme is used to simulate dendritic growth from a supercooled melt in external flows with different geometries.

The phase change part of the problem is treated with the phase-field approach of Karma and Rappel, whereas the flow of the liquid is simulated by a standard lattice-Boltzmann-BGK (LBGK) method with interactions with solid and thermal convection incorporated. To simulate conductive and convective heat transfer we use the multicomponent LBE method.

Growth of patterns in a shear flow was simulated for different flow velocities. The results show much stronger influence of the flow on doublons than on dendrites.

The effect of parallel flow on dendritic growth was investigated for different undercooling, flow velocity and viscosity, and channel width. Decrease of the channel width leads to significant changes in the shape and operating parameters of the dendrite.

DY 34.84 Mo 15:30 Poster TU D

Phase-field simulation of pattern formation during GeSi crystal growth — •Wolfram Miller und Igor Rasin — Institut für Kristallzüchtung (IKZ), Max-Born-Str.2, 12489 Berlin

A modified version of the phase-field model of Kim et al. is used for calculating the solidification of binary system GeSi. The phase-field equation is solved by a finite-difference scheme. A recently developed kinetic scheme is used to compute the transport of silicon in the germanium melt. This allows the computation of pattern formation even in cases of low undercooling within reasonable times. We have studied the cellular growth in the regime of crystal growth experiments at the IKZ for different growth velocities and temperature gradients.

[1] Seong Gyoon Kim, Won Tae Kim, and Toshio Suzuki, Phys. Rev. E 60 (1999), 7186

DY 34.85 Mo 15:30 Poster TU D

Simulation of heteroepitaxial growth and misfit dislocations — •Markus Walther[1], Michael Biehl[1,2], Florian Much[1], and Christian Vey[1] — [1]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, D-97074 Würzburg — [2]Institute for Mathematics and Computing Science, University of Groningen, P.O. Box 800, NL-9700 AV Groningen

The atomistic simulation of strain effects in heteroepitaxial systems requires the development of off-lattice models which allow for continuous positions of the particles. We present the results of kinetic Monte Carlo simulations of heteroepitaxial growth where the particle interactions are described by simple pair-potentials, e.g. Lennard-Jones or Morse potentials in 1+1 dimensions. The lattice spacing of adsorbate materials differs from that of the substrate, resulting in the appearance of misfit dislocations at a characteristic film thickness. One important aspect is the relaxation of the vertical lattice spacing above the dislocations. Our findings are compared with experimental results on a qualitative level.

DY 34.86 Mo 15:30 Poster TU D

Simulation of heteroepitaxial growth and surface alloy formation — •Sebastian Weber[1], Thorsten Volkmann[1], Michael Biehl[1,2], and Miroslav Kotrla[3] — [1]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, D-97074 Würzburg — [2]Institute for Mathematics and Computing Science, University of Groningen, P.O. Box 800, NL-9700 AV Groningen — [3]Institute of Physics, Academy of Sciences of the Czech Republic, Prague

We study the hetero-epitaxial growth of an fcc(111) crystal surface, in which the lattice spacing of adsorbate materials differ from that of the substrate. We employ off-lattice equilibrium and kinetic Monte Carlo simulations based on simple model interactions between the particle species. Emphasis is on the formation of monolayers of binary adsorbates with a nontrivial composition profile. One important aspect is the formation of nano-structured surface alloys and the dependence on growth temperature and lattice mismatch.

DY 34.87 Mo 15:30 Poster TU D

What are the Mechanisms Governing Crystal Growth from Solution? A Computer Simulation Study. — •F. Kalischewski and A. Heuer — Institut für Physikalische Chemie, WWU, 48149 Münster

Oscillatory zoning is a frequently encountered phenomenon in solid solutions. It is characterized by periodic component-concentration fluctuations along the core-rim profile of a crystal. Putnis *et al.* showed the appearance of Oscillatory zoning in the absence of substrate fluctuations and convection. Thus this phenomenon can be ascribed to complex self-organizing interactions between thermodynamics and kinetics. A theoretical understanding of these interactions requires a detailed knowledge of the microscopic processes.

Our attempt is to gain deeper insight on the underlying mechanisms of this problem by molecular simulation. We apply the lattice free Monte-Carlo method to a system containing a crystal-seed surrounded by solvent. The crystallization behavior of solute particles is monitored by several "observables" such as their crystallization sites, number of (re)crystallizations, surface-diffusion as well as complete desorption. First

results will be shown.

DY 34.88 Mo 15:30 Poster TU D

Kinetic Monte-Carlo simulations of sintering — •Frank Westerhoff, Ruslan Zinetullin, and Dietrich E. Wolf — Computational Physics, Universität Duisburg-Essen

We simulate the sintering of particle aggregates by means of surface diffusion. As a method we use Kinetic Monte-Carlo simulations in which elasticity can explicitly be taken into account. Therefore it is possible to investigate the shape relaxation of aggregates also under the influence of an outer pressure. Without elasticity we investigate the relaxation time and surface evolution of sintering aggregates and compare the simulations with the classical Koch-Friedlander theory. Differences to the theoretical predictions will be discussed.

DY 34.89 Mo 15:30 Poster TU D

Acoustic measurement of velocity-dependent coefficients of restitution — •A. Butsch, C.A. Krülle, and I. Rehberg — Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth

There are many ways to measure the restitution coefficient of an impact between a vertically falling sphere and a smooth horizontal surface. A very simple and practical method was suggested by Alan D. Bernstein (Am. Jour. Physics 45, 41 (1977)). It is based on the analysis of the sound signal produced by the collision between a falling sphere and a horizontal surface. The required instruments for this experiment are a microphone and a computer with a sound card for recording and evaluation of the stored data. The aim of this project is to determine the coefficient of restitution for beads of different material and size. We are especially interested in the dependency of the restitution coefficient on the impact velocity. The obtained data will serve for modelling of the transport behavior of granular matter under vibration.

DY 34.90 Mo 15:30 Poster TU D

Axial segregation in a long horizontal rotating drum — •Tilo Finger[1], Thomas John[2], Andreas Voigt[3] und Ralf Stannarius[1] — [1]Institut für Experimentelle Physik, Otto-von-Guericke Universität Magdeburg — [2]Institut für Physik, Carl-von-Ossietzky Universität Oldenburg — [3]Max Planck Institut für Dynamik komplexer technischer Systeme Magdeburg

The axial segregation of granular material in a long horizontal rotating drum is a well known phenomenon studied by several groups. We investigate experimentally the structures and the long time behaviour of this process. The drum is half filled with a mixture of glass beads of two different diameters and filled up with water. After starting a constant rotation the material shows a radial segregation in time scales of few seconds. In time scales of few minutes an additional axial segregation appears and a stripe pattern along the cylinder axis becomes visible. The initial width of stripes is more or less regular. When the rotation continues, the number of stripes decreases. The time scale of coarsening of the pattern is of the order of several hours up to days. We measure the coarsening at different rotation frequencies and determine the three dimensional distribution of the grains by magnetic resonance imaging.

DY 34.91 Mo 15:30 Poster TU D

Condensation of granular matter in a vertical shaker — •C.-H. Tai and C.A. Krülle — Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth

If an ensemble of macroscopic particles is mechanically excited by vertical vibrations, the energy input is dissipated into the system by multiple inelastic collisions. As a result, when a monodisperse set of glass beads exceeds a critical number of particles a phase transition can be observed from a fluidized gas-like state to a condensed crystalline state. Systematic studies of the dependence of this critical number on the internal parameters (size and material density of the spheres) as well as the external conditions (amplitude and frequency of the shaker) are presented.

DY 34.92 Mo 15:30 Poster TU D

Distribution of Liquid in Wet Granular Matter — •Mario Scheel[1], Klaus Mecke[2], Stephan Herminghaus[1], Marco DiMichiel[3], and Ralf Seemann[1] — [1]MPI for Dynamics and Self-Organization, D-37073 Göttingen — [2]University of Erlangen, D-91058 Erlangen — [3]ESRF, F-38043 Grenoble Cedex 9,

When wetted with moderate amounts of liquid, granular materials change their mechanical properties dramatically. This is most prominently observed comparing dry sand, as found in the desert, to the shapeable solid of which sand castles are made. The reason for this effect are the microscopic capillary bridges forming between adjacent grains, which by virtue of surface tension make a soft solid out of what was a heavy dissipative gas. The morphology of this complex network of liquid bridges is directly connected to the mechanical properties of the wet granulate. We have studied this network by using X-ray tomography, which we applied to random packings of small (few 100 microns diameter) glass spheres, wetted by a contrasting liquid. Upon increasing the liquid content, we find a crossover from individual bridges to random clusters of liquid. Geometrical quantities are compared to what has been obtained earlier with optical immersion techniques. A particular advantage of our setup is the possibility to study dynamical phenomena, which allowed us to investigate the imbibition of a front of liquid into the granular pile.

DY 34.93 Mo 15:30 Poster TU D

Investigations of horizontally shaken granular materials – the brazil-nut effect and nonspherical particles — •Olaf Brökmann und Achim Kittel — Carl-von-Ossietzky Universität Oldenburg, Institut für Physik, 26111 Oldenburg

We investigated horizontally shaken granular material. The studies include an analysis of the velocity fields of the granular material. Therefore particle image velocimetry (PIV) is used, a measuring method which is usually used for investigation of flow fields in fluids. One aspect of our research is the investigation of the so called brazil-nut effect, i.e. the rise of larger particles in a granular bed. We found results concerning its origin and features. Other results were obtained by investigating nonspherical granular materials. The investigation of shaken rice uncovers interesting features like the formation of layers with horizontal and vertical orientated rice grains.

DY 34.94 Mo 15:30 Poster TU D

Kolmogorov-Sinai Entropy of Wet Granular Gas — •Axel Fingerle, Vasily Zaburdaev, and Stephan Herminghaus — MPI for Dynamics and Self-Organisation, Bunsenstraße 10, 37073 Göttingen

Wet granular matter is a fast developing and modern branch of Soft Matter Physics. There is a growing number of experimental and numerical works, but the theoretical background is far behind that. We try to treat the wet granulate as a complex dynamical system and to use powerful tools available in this area. Such is for example the Lyapunov spectrum. A positive Lyapunov exponent indicates chaotic behavior. We aim to calculate the Kolmogorov-Sinai (KS) entropy [1], which in our case is the sum of positive Lyapunov exponents. We apply a technique similar to [2] developed for a gas of hard spheres. The main peculiarity of our system is the *hysteretic nature* of the interaction due to the liquid bridge formed upon each collision of two particles. By averaging binary collisions using the distributions of the N-particle system for velocities and free paths, we obtain an analytic expression for the KS entropy. The distribution functions of the velocities and impact parameter in real granular systems are also discussed.

[1] J.-P. Eckmann and D. Ruelle, Rev. Mod. Phys. **57**, 617 (1985).
[2] H. van Beijeren, J.R. Dorfman, H.A. Posch, and Ch. Dellago, Phys. Rev. E **56**, 5272 (1997).

DY 34.95 Mo 15:30 Poster TU D

Large Height fluctuations in a two-dimensional air fluidized bed — •Sabrina Nagel, Matthias Schröter, and Harry Swinney — Center for Nonlinear Dynamics, University of Texas at Austin

This work examines relaxation and compaction of a two dimensional granular system. It tests a proposed thermodynamic description of static granular media introduced by Edwards and co-workers. After being tapped with a pulse of air, the binary granular bed relaxes into a steady state volume about which the volume fluctuates as tapping goes on. The idea is to use the volume fluctuations to determine the compactivity X, which was introduced by Edwards and co-workers. For this purpose, a Gaussian is fitted to the histogram of deviations from the local average. The variance of the Gaussian is needed to calculate X. The steady state volume depends on the parameters of the tap, pulse duration and pulse strength. We found that the variance is a function of the steady state volume. This indicates that X is indeed a well-defined parameter.

DY 34.96 Mo 15:30 Poster TU D

Rotating granular flow: variing the Froude number by variing g — •A. Brucks[1], H. Oelze[1], S. Odenbach[1], and R. Lueptow[2] — [1]Zentrum f. angew. Raumfahrttechnologie u. Mikrogravitation, Universität Bremen, Am Fallturm, 28357 Bremen — [2]Dept. of Mechanical Engineering, Northwestern University, 2145 Sheridan Road, Rm. B223 Evanston, IL 60208-3111, USA

The effect of hyper gravity on granular flow in rotating tumblers is presented. For the flow in granular materials under motion in a rotating quasi 2D tumbler four characteristic flow types are known: avalanching, cascading, cataracting and centrifuging system. The Froude number, relating centrifugal forces and gravity in the system, is often used as a dimensionless parameter charaterizing the different flow regimes. Up to now experiments have been performed variing the Froude number by geometry and angular velocity.

In this study the focus lies on the variation of g and thus finding more hints whether the Froude number is the best dimensionless parameter to describe this problem.

DY 34.97 Mo 15:30 Poster TU D

Segregation effects in a swirled bowl — •T. Schnautz[1], C.A. Krülle[1], I. Rehberg[1], and R. Brito[2] — [1]Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth — [2]Fisica Aplicada I, Universidad Complutense, E-28040 Madrid

We present experimental results on the segregation of a binary mixture of spheres. These are compared with the results of a numerical simulation of sliding disks with additional sphere characteristics. Depending on the filling fraction in the system a monodisperse layer of spheres shows a "plastic"-liquid-like, and a liquid-solid-like phase transition. At slightly higher densities segregation effects, similar to the Brazil-nut effect and its reverse, occur for binary mixtures. So a phase transition seems to be a precondition for segregation. These critical particle densities are both found to be independent of the driving frequency, but decrease with increasing vibration amplitude.

DY 34.98 Mo 15:30 Poster TU D

Solid - fluid transition of a monlayer of particles: MD simulations — •Jennifer Kreft[1,2], Andreas Götzendorfer[2], Christof Krülle[2], and Ingo Rehberg[2] — [1]Center for Nonlinear Dynamics, Universtiy of Texas at Austin — [2]Experimentalphysik V, Universität Bayreuth

Granular media can resemble different states of matter such as a solid, liquid and gas. Since grains are dissipative, maintaining a fluid like state requires constant input of energy. We study granular material that is shaken in both the horizontal (perpendicular to gravity) and vertical (parallel to gravity) directions with peak accelerations between 1 and 1.5 times gravity. When a single monolayer of particles is excited in this manner, a coexistence of the fluid like and solid like phases of the grains persists for many thousands of cycles. A molecular dynamics, event driven, three dimensional simulation of frictional hard spheres is used to study this phenomenon. The size of the fluidized region and the horizontal speed at which the boundary between states travels in simulation are compared to experimental results. Also, the granular temperature and trajectories of the grains are analyzed to investigate how the different regions can stably coexist.

DY 34.99 Mo 15:30 Poster TU D

Dynamics of granular avalanches caused by local perturbations — •Thorsten Emig[1], Philippe Claudin[2], and Jean-Philippe Bouchaud[3] — [1]Institut für Theoretische Physik, Universität zu Köln, Zülpicher Str. 77, 50937 Köln — [2]Laboratoire de Physique et Mécanique des Milieux Hétérogènes, ESPCI, 10 rue Vauquelin, 75231 Paris Cedex 05, France — [3]Service de Physique de l'État Condensé, Centre d'études de Saclay, Orme des Merisiers, 91191 Gif-sur-Yvette Cedex, France

Surface flow of granular material is investigated within a continuum approach in two dimensions. The dynamics is described by the non-linear coupling between a mobile layer and an erodible bed of static grains. Following previous studies, we use mass and momentum conservation to derive St-Venant like equations for the evolution of the thickness of the mobile layer and the profile of the bed. This approach allows the rheology in the flowing layer to be specified independently, and we consider in details the two following models: a constant plug flow and a linear velocity profile. We study and compare these models for non-stationary avalanches triggered by a localized amount of mobile grains on a bed of initially constant slope. We solve analytically the non-linear dynamical equations by the method of characteristics. This enables us to investigate the temporal evolution of the avalanche size, amplitude and shape as a function of model parameters and initial conditions. In particular, we can compute their large time behavior as well as the condition for the formation of shocks.

DY 34.100 Mo 15:30 Poster TU D

Dielectric properties of the polarizable Stockmayer fluid via molecular dynamics simulation using the Debye equation — •Jörg Bartke and Reinhard Hentschke — Fachbereich Mathematik und Naturwissenschaften, Bergische Universität, Wuppertal

The Stockmayer potential is employed in numerous model studies focusing on the properties of dipolar fluids. Of special interest is the static dielectric constant, i.e. its dependence on thermodynamic conditions. Determination of the dielectric constant usually is based on the Kirkwood-Froehlich-fluctuation equation. However, using this equation in computer simulations involves a number of subtle considerations depending on the boundary conditions and the symmetries of the system. Compared to the Kirkwood-Froehlich approach Debye's equation is easier to use, but, to our knowledge, has never been applied to the Stockmayer fluid, even though the local field can be obtained quite accurately with no great effort. Here we compare the static dielectric constant of the polarizeable Stockmayer fluid obtained via the equations of Debye and Kirkwood-Froehlich applied to molecular dynamics simulation trajectories for a wide range of thermodynamic conditions.

DY 34.101 Mo 15:30 Poster TU D

Experiments on Chain Formation Dynamics in Inverse Ferrofluids — •Tobias Sebald[1], Reinhard Richter[1], Christian Gollwitzer[1], Tobias Schnautz[1], Ruben Saldivar-Guerrero[1,2], and Ingo Rehberg[1] — [1]Experimentalphysik V, University of Bayreuth, D-95440 Bayreuth, Germany — [2]Centro de Investigacion en Quimica aplicada, 25100 Saltillo, Coahuila, Mexico

By disperging microsized polystyrene particles in ferrofluid an ideal magneto-rheological model fluid can be synthesized. The nonmagnetic polystyrene particles create holes in the ferrofluid, which appear to posses a magnetic moment corresponding to the amount and suszeptibility of the displaced fluid. Due to the dipolar interactions of the holes, chain formation sets in. We investigate this process in a quasi two dimensional layer inbetween two glass plates via a long distance video microscope. Here the magnetic field is oriented parallel to the plates, and applied in a pulse like manner. The number of particles in the chains and columns are extracted from the pictures. The average length shows to follow a logistic function in time. Moreover, structure formation of the agglomerates under shear flow is experimentally investigated.

DY 34.102 Mo 15:30 Poster TU D

Rotational Diffusion near Confining Walls — •Heidrun Gleisberg, Patrick Ilg, and Siegfried Hess — Institut für Theoretische Physik, Hardenbergstr. 36, Technische Universität Berlin

A simple model is proposed to study the influence of confining walls on the rotational dynamics of a molecule, with emphasis on the rotational diffusion coefficient.

In particular, a time reversible dynamics is considered which employs a recently introduced thermostat for rotational motion [1]. This model is compared to the corresponding approach via the irreversible Langevin equation.

Analytical and numerical results for a molecule in a channel are presented, exhibiting an interesting dependence of the rotational diffusion coefficient on the imposed spatial restrictions.

[1] S.Hess, Z. Naturforsch. **58a**, 377 (2003)

DY 34.103 Mo 15:30 Poster TU D

The planar-fingerprint transition in a thermo-reversible liquid crystalline gel — •Alberto de Lózar, Wolfgang Schöpf, Ingo Rehberg, Oscar Lafuente, and Günter Lattermann — Univerisität Bayreuth

A thermo-reversible (physical) gel consisting of a nematic liquid crystal mixed with a small quantity of a chiral organogelator is investigated in the planar configuration. The response of the system to an external electric field reveals multistability within a small hysteresis. The relaxation of the liquid crystal under this field is characterized by two different time scales: a fast one that is connected to the tilt of the director field, and a slow one that describes the reorientation of the chiral structure. In the first case, the relaxation is non-exponential and can be described by a

Kohlrausch-Williams-Watts law with a stretching parameter of 0.5.

DY 34.104 Mo 15:30 Poster TU D

Das Phasendiagramm harter Sphärozylinder und Messung der Grenzflächenspannung — •Stefan Wolfsheimer, Richard Vink und Tanja Schilling — Institut für Physik, Staudinger Weg 7, 55099 Mainz

Zur Untersuchung von Flüssigkristallen verwendet man als theoretisches Arbeitsmodell häufig harte Sphärozylinder. Auf diesem Poster berichten wir über die Bestimmung des Phasendiagramms einer Suspension harter Sphärozylinder in der Nähe des isotropen - nematischen Übergangs mithilfe einer großkanonischen Monte-Carlo-Simulation. Dabei wurde die Dichte und der Orientierungsordungsparameter in Abhängigkeit des chemischen Potenzials aufgenommen. Desweiteren wurde unter Verwendung von Umbrella-Sampling und Histogram-Reweighting ein sehr genauer Wert des chemischen Potenzials bei Koexistenz und die Grenzflächenspannung zwischen isotroper- und nematischer Phase gemessen.

DY 34.105 Mo 15:30 Poster TU D

Kinetic Ising Model with Memory — •Thomas Michael and Steffen Trimper — Fachbereich Physik, Martin-Luther-Universität, Friedemann-Bach-Platz, 06108 Halle

The kinetic Ising model is studied alternatively by using a second quantized formalism for the underlying Master equation. Whereas in the original model due to Glauber the temperature is incorporated in the transition probability for the single spin-flip-process, in our approach the temperature is taken into account from the beginning by introducing a pseudo-Heisenberg picture of the operators. The method enables us to calculate the moments by applying the algebraic properties of the Pauli-operators. As a result we get an exact expression for the transition probability with a time scale, depending on the relevant spin variable. In the vicinity of the critical point the transition probability is similar to the original expression where the differences will be discussed, especially for low temperatures. Near to the phase transition it is possible to derive a Ginzburg-Landau expansion. As an extension of our procedure we study the influence of short and long range memory effects within the kinetic Ising model. Near to Tc we observe an oscillatory behaviour.

DY 34.106 Mo 15:30 Poster TU D

Melting transitions of fluxline arrays — •Roland Schorr and Ludger Santen — Universität des Saarlandes, FR7.1 Theoretische Physik, Postfach 151150, 66041 Saarbrücken

We investigate the "melting transition" of fluxline arrays. The fluxlines are modeled as interacting elastic lines on two and three dimensional lattices. The model under consideration can be mapped on the six vertex model, which allows for very efficient simulations by using cluster MC algorithms, i.e. we obtain a vanishing dynamical exponent for the pure case. One observes two kinds of melting transitions either driven by the disorder or the temperature. In the pure case we observe a continuous melting of the fluxline lattice.

DY 34.107 Mo 15:30 Poster TU D

Monte-Carlo simulations of small metal clusters with DFT abinitio energy surfaces — •Günter Schneider and Ralph Werner — Institut für Theorie der Kondensierten Materie, Universität Karlsruhe, D-76128 Karlsruhe

We investigate the melting and evaporation transition of small metal clusters by calculating the specific heat and bond length fluctuations with Monte-Carlo simulations in the canonical ensemble. Results for density functional theory (DFT) calculations for the potential energy are compared with those for effective many-body (Gupta) potentials for the case of Al clusters. While the details of the transitions depend on the potentials and the resulting structures, the qualitative behavior is found to be similar. The interplay between the melting and evaporation transition in Sn_{10} clusters is studied in detail in comparison with recently published results [2].

[1] R. Werner, submitted to Eur. Phys. J. B (2004).
[2] K. Joshi, D. G. Kanhere, and S. A. Blundell, Phys. Rev. B **66**, 155329 (2002)

DY 34.108 Mo 15:30 Poster TU D

Phase-Ordering and Aging Phenomena in Potts Models — •Eric Lorenz and Wolfhard Janke — Institut für Theoretische Physik, Universität Leipzig, Augustusplatz 10/11, 04109 Leipzig, Germany

Dynamical properties of Potts models with $q = 2$ and $q = 3$ are studied during phase-ordering through numerical simulations with a nonconserved order parameter. The systems are quenched from a highly disordered state into the ferromagnetic phase ($T < T_c$) whereafter the dynamical self-similarity of phase-ordering shows up. To reveal this aging phenomenon two-time quantities such as the autocorrelation $A(t, s)$, autoresponse $R(t, s)$ and spatiotemporal response $R(t, s, r)$ are measured and compared with scaling functions predicted from local scale invariance.

DY 34.109 Mo 15:30 Poster TU D

Quantum Phase Transitions in Inhomogeneous Spin Chains — •Rainer Bischof, Sandro Wenzel, Peter Crompton und Wolfhard Janke — Institute of Theoretical Physics, University of Leipzig, Augustusplatz 10/11, 04109 Leipzig, Germany

We identify the exponents associated with a second order quantum critical point in mixed-periodic spin chains of S = 1/2, 1, 3/2, via quantum Monte Carlo simulations. According to Haldane's conjecture gaps can occur above the ground state of metallic compounds at low-temperatures, but only for integer spin systems. Our investigation focuses on the experimentally relevant effect of doping quasi-1d metallic compounds with ions of higher spin. We show that, via doping, the original NLSM analysis can be extended to a broader range of systems and newly identify 'spin-glass' behaviour for half-integer inhomogeneous systems at low-temperatures.

DY 34.110 Mo 15:30 Poster TU D

Series expansions for disordered Potts models — •Meik Hellmund[1] and Wolfhard Janke[2] — [1]Mathematisches Institut, Universität Leipzig — [2]Institut für Theoretische Physik, Universität Leipzig

We derive high-temperature series expansions for the free energy and the susceptibility of random-bond q-state Potts models on hypercubic lattices using a star-graph expansion technique. This method enables the exact calculation of quenched disorder averages for arbitrary uncorrelated coupling distributions. Moreover, we can keep the disorder strength p as well as the dimension d as symbolic parameters. By applying several series analysis techniques to the new series expansions, one can scan large regions of the (p, d) parameter space for any value of q. We present results for the transition temperature and the effective critical exponent γ as a function of p for the diluted Ising model in three dimensions and discuss the observed crossover behaviour. As a by-product we get high-temperature series in the parameter q for pure q-state Potts models up to order 19 which allow us to analyze the different $q \to 0$ limits (percolation, tree percolation) in various dimensions.

DY 34.111 Mo 15:30 Poster TU D

Shape of critical fluctuations in LJ-fluids and wet granular media — •Christian Goll [1] and Klaus Mecke[1,2] — [1]MPI für Metallforschung, Stuttgart — [2]Institut für theoretische Physik, Universität Erlangen-Nürnberg, Staudtstrasse 7, D-91058 Erlangen

We present a molecular dynamics simulation of a Lennard-Jones fluid close to the liquid-vapor critical point to study the shape of the fluctuating configurations. Clusters of size R are defined by attaching spheres of radius R at each particle. The shape is measured by Minkowski functionals M_ν of the covered region in space. An effective local cluster shape m_ν is defined which takes all n-point correlations on scales smaller than $2R$ into account and describes the local structure in an illustrative way (depletion zone, clustering). A possible scaling behavior $m_\nu \sim R^{\alpha_\nu}$ is analysed at large lengths R where multi-point correlations become important which are not captured by the scaling of two-point structure function alone. We applied the same simulation and morphometric technique to a shear-induced solid-fluid transition in wet granular matter, where dissipation occurs in a hysteretic nature of a cohesive force induced by adsorbed liquid bridges between the spherical particles. Comparision of the critical morphology with LJ-fluid and with recent x-ray tomography data of wet bead packs are presented.

DY 34.112 Mo 15:30 Poster TU D

Spinodal decomposition in a three-dimensional Lennard-Jones fluid: A molecular dynamics study — •Hendrik Kabrede and Reinhard Hentschke — Fachbereich Mathematik und Naturwissenschaften, Bergische Universität, Wuppertal

Spinodal decomposition in a three-dimensional Lennard-Jones fluid with one million particles is studied via molecular dynamics. The large size allows the system to decompose into domains with different densities and clearly distinguishable domain boundaries. The atomistic description makes it possible to study relevant physical quantities like the Ginzburg-Landau free energy, the underlying density field, and velocity field on a coarse grained scale. We show that over a wide time range there is no directed velocity field. Thus, such a field is irrelevant for the phase separation description in the analyzed time range. The pair correlation function and the structure factor show scaling behavior over a wide time range. The asymptotic structure factor obeys the predicted power laws, and the domain growth follows $t^{1/2}$.

DY 34.113 Mo 15:30 Poster TU D

Lattice solitons under dissipative and stochastic forces — •Christian Brunhuber and Franz Georg Mertens — Universitaet Bayreuth, TP 1 , Universitaetsstr. , 95440 Bayreuth

Anharmonic atomic chains can posses soliton solutions which were used in the past to model different physical phenomena. The shape of the lattice solitons depends strongly on the interaction potential of the particles (e.g. non-local forces). We study the motion of such excitations in the presence of thermal fluctuations and/or dissipation. We apply both analytical calculations in the continuum limit and simulations of the discrete chain. We observe that the perturbed solitons show surprising phenomena concerning their stability and diffusive behaviour.

DY 34.114 Mo 15:30 Poster TU D

Violation of the scaling law and universality hypotheses in the statistical models — •Eugenia Soldatova and Alexandra Galdina — Dniepropetrovsk National University, Ukraine

Successes of the modern theory of critical phenomena have been connected with the fundamental conclusions about the critical state nature and existence of the class of systems, for which both the scaling law hypothesis and universality one are fulfilled. From this point of view real systems and consistent models contradicting to above-mentioned hypotheses are the problem of great importance. The 6-vertex Lieb model and 8-vertex Baxter model are such models. We have analyzed the critical properties of the models on the basis of the thermodynamic method of investigation of one-component system critical state. The method is based on the critical state definition and its stability examination. It leads to existence of four types of critical behaviour [1]. The following conclusions have been made:

The violation of the scaling law hypothesis in the Lieb model is caused by the realization of different behaviour types in subcritical and supercritical regions;

The violation of universality hypothesis is concerned with two different behaviour types depending on an interaction parameter. Moreover, one of these types is represented by three cases (with different critical slope of phase equilibrium curve).

[1] E.D.Soldatova, Cond. Matt. Phys. **2**(4), 603 (1999)

DY 34.115 Mo 15:30 Poster TU D

Transport through double barriers in Luttinger liquids — •Tilman Enss[1], Sabine Andergassen[1], Volker Meden[2], Xavier Barnabé-Thériault[2], Walter Metzner[1], and Kurt Schönhammer[2] — [1]Max-Planck-Institut für Festkörperforschung, Stuttgart — [2]Institut für Theoretische Physik, Universität Göttingen

We study the conductance through an interacting nanowire containing impurities and coupled to non-interacting leads. Our functional RG method starts from the microscopical model and arrives at an effective low-energy model showing Luttinger-liquid behavior. For a double barrier enclosing a dot region, the conductance is determined over several decades of the temperature and for arbitrary impurity strength. Depending on the parameters of the dot we find temperature regimes in which the conductance follows power laws with universal exponents as well as non-universal behavior.

DY 34.116 Mo 15:30 Poster TU D

Functional RG for Luttinger liquids with impurities — •Sabine Andergassen[1], Tilman Enss[1], Volker Meden[2], Walter Metzner[1], Ulrich Schollwöck[3], and Kurt Schönhammer[2] — [1]Max-Planck-Institut für Festkörperforschung, Stuttgart — [2]Universität Göttingen — [3]Technische Hochschule Aachen

We improve the recently developed functional renormalization group (fRG) for impurities and boundaries in Luttinger liquids by including renormalization of the two-particle interaction, in addition to renormalization of the impurity potential. Explicit flow equations are derived for spinless lattice fermions with nearest neighbor interaction at zero temperature, and a fast algorithm for solving these equations for very large systems is presented. We compute spectral properties of single-particle excitations, and the oscillations in the density profile induced by impurities or boundaries for chains with up to 10^6 lattice sites. The expected asymptotic power-laws at low energy or long distance are fully captured by the fRG. Results on the relevant energy scales and crossover phenomena at intermediate scales are also obtained. A comparison with numerical density matrix renormalization results for systems with up to 1000 sites shows that the fRG with the inclusion of vertex renormalization is remarkably accurate even for intermediate interaction strengths.

DY 34.117 Mo 15:30 Poster TU D

Critical dynamics of disordered model C — •Reinhard Folk[1], Maxym Dudka[1,2], Yurij Holovatch[1,2,3], and Günter Moser[4] — [1]Institute für Theoretische Physik, Johannes Kepler Universität Linz, A-4040 Linz, Austria — [2]Institute for Condensed Matter Physics, National Academy of Sciences of Ukraine, UA-79011 Lviv, Ukraine — [3]Ivan Franko National University of Lviv, UA-79005 Lviv, Ukraine — [4]Abteilung für Physik und Biophysik, Univerität Salzburg, A-5020 Salzburg, Austria

We study the relaxational critical dynamics of the φ^4-model with an additional coupling between the order parameter φ and a conserved density - model C [1,2] - in presence of disorder. The asymptotic critical behavior of this model reduces to that of model A. However, the disorder affects considerably the non-asymptotic dynamical behavior. A field-theoretical renormalization group analysis of disordered model C is possible observing the same structure for dynamical vertex functions as for pure model. The investigations of asymptotic and effective critical behavior are performed mostly for region $n < n_c$, where disorder is relevant in statics. The non-monotonic character of the temperature dependence of the dynamical effective critical exponent z_{eff} at approach to the asymptotic regime is demonstrated.

[1] B. I. Halperin, P. C. Hohenberg, S.-k. Ma, Phys. Rev. B **10**, 139 (1974).

[2] R. Folk, G. Moser, Phys. Rev. Lett. **91**, 030601 (2003); R. Folk, G. Moser, Phys. Rev. E **69**, 036101 (2004).

DY 34.118 Mo 15:30 Poster TU D

Critical dynamics of a stochastic model with two conserved densities — •Reinhard Folk[1] and Günter Moser[2] — [1]Institute for Theoretical Physics, University of Linz, Austria — [2]Institute for Physics and Biophysics, University of Salzburg, Austria

We calculate the field theoretic functions of the generalized dynamical model C*', where two conserved secondary densities are coupled to a nonconserved complex order parameter (OP), in two-loop order. A transformation to 'orthogonalized' densities can be performed where only one secondary density with nontrivial static coupling to the OP exists while the second one remains Gaussian. The secondary densities remain dynamically coupled by the nondiagonal diffusion coefficent.

General relations for the field theoretic functions allow to relate the asymptotic critical properties of model C*' to the simpler model C* with only one conserved density coupled to the OP, the nonasymptotic properties however differ as can be seen from the flow of the dynamic parameters, which is presented for the case of a real OP with componets n=1,2,3.

DY 34.119 Mo 15:30 Poster TU D

Diffusion in a fluctuating membrane — •Ellen Reister and Udo Seifert — II. Institut für theoretische Physik, Universität Stuttgart, Pfaffenwaldring 57/III, 70550 Stuttgart

Experimental techniques, like fluorescence correlation spectroscopy, track the movement of fluorescent probes in membranes in order to determine diffusion constants. However, the deduction of diffusion constants from experimental data generally assumes that diffusion takes place in a plane, although real membranes are subject to thermal fluctuations. We

are interested in the interplay of membrane fluctuations and diffusion within a membrane. To study the system we regard Brownian motion of particles on a curved surface. The particles are free to move within the membrane without influencing the membrane shape. The fluctuations of the membrane, that is described by a Helfrich Hamiltonian, lead to a time dependent metric of the curved surface. We calculate the rescaled projected diffusion constant for a fluctuating membrane and estimate the difference between the real and projected diffusion constant under typical experimental conditions.

DY 34.120 Mo 15:30 Poster TU D

Statistics of transition times, phase diffusion and synchronization in periodically driven bistable systems — •Michael Schindler[1], Peter Talkner[1], Lukasz Machura[1,2], Peter Hänggi[1] und Jerzy Łuczka[2] — [1]Theoretical Physics I, Institute of Physics, Augsburg University, Germany — [2]Department of Theoretical Physics, Institute of Physics, Silesian University, Poland

The statistics of transitions between the metastable states of a periodically driven bistable Brownian oscillator are investigated on the basis of a two-state description by means of a master equation with time-dependent rates. The results are compared with extensive numerical simulations of the Langevin equation for a sinusoidal driving force. Very good agreement is achieved both for the counting statistics of the number of transitions per period and the residence time distribution of the process in either state. The counting statistics corroborate in a consistent way the interpretation of stochastic resonance as a synchronization phenomenon for a properly defined generalized Rice phase [1].

[1] P. Talkner, L. Machura, M. Schindler, P. Hänggi and J. Łuczka, New Journal of Physics (January 2005); preprint physics/0409065