DY 10: Posters I

Time: Monday 17:00–19:00 Location: P4

DY 10.1 Mon 17:00 P4

Zeroth law and fluctuation relations for driven lattice gases in contact: A numerical study — •Robert Ramsperger, Punyabrata Pradhan, and Udo Seifert — II. Institut für Theoretische Physik, Universität Stuttgart, 70550 Stuttgart, Germany

We numerically study two-dimensional driven lattice gases to check the existence of an intensive thermodynamic variable which could determine "equilibration" between two driven lattice-gas systems being brought into contact [a part of the detailed results discussed here have appeared in Phys. Rev. Lett. **105**, 150601 (2010)]. We consider driven interacting particle systems where the microscopic interaction strengths and driving fields may be different in each of the systems. Two such systems in contact can exchange particles through the contact area with the total number of particles conserved. The contact area consists of a small number of sites ("weak contact") or a large number of sites ("strong contact"). Interestingly, we find that, to a very good approximation, there is an intensive variable, like equilibrium chemical potential, which determines the final steady state of two driven lattice gases in contact. Moreover, in the weak contact limit, a fluctuation-response relation between the fluctuations in particle-number and the corresponding susceptibility is also well satisfied. We also discuss the observable violations to these simple thermodynamic laws. We study in detail how the densities and the fluctuations in a driven system in contact with a particle reservoir depend on the driving field, size and shape of the system, size and shape of the contact area as well as the properties of the reservoir.

DY 10.2 Mon 17:00 P4

Time-dependent density functional theory for driven lattice gas systems with interactions — •Marcel Dierl[1,2], Philipp Maass[2], and Mario Einax[1,2] — [1]Institut für Physik, Technische Universität Ilmenau, 98684 Ilmenau, Germany — [2]Fachbereich Physik, Universität Osnabrück, Barbarastraße 7, 49076 Osnabrück, Germany

Driven lattice gases are widely used model systems to study non-equilibrium processes in physics, biology and chemistry. So far most studies were carried for lattice systems with only hard-core exclusions. Here we present a new method to describe the kinetics of driven lattice gases with particle-particle interactions beyond hard-core exclusions. The method is based on the time-dependent density functional theory for lattice systems and allows one to set up closed evolution equations for mean site occupation numbers in a systematic manner. Application of the method to a totally asymmetric site exclusion process with nearest-neighbor interactions yields predictions for the current-density relation in the bulk, the phase diagram of non-equilibrium steady states and the time evolution of density profiles that are in good agreement with results from kinetic Monte Carlo simulations.

DY 10.3 Mon 17:00 P4

Migration of semiflexible polymers in a pressure driven flow — •Sebastian Reddig and Holger Stark — Institut für Theoretische Physik, TU-Berlin

Experiments on single α-actin filaments in microchannels showed that the steady state center-of-mass probability density is nonuniformly distributed across the channel under the influence of a Poiseuille flow[1]. Depletion layers near the walls and in the centerline were observed. Hydrodynamic interactions between the polymer and the walls lead to migration away from the walls, while a spatially varying diffusion coefficient resulting from a locally varying polymer conformation drives the polymer away from the centerline. These competing mechanisms give the observed bimodal distribution.

We introduce a model for a semiflexible polymer under the influence of a pressure driven flow, which is confined between two parallel planar walls. The polymer is modelled by a bead-spring chain including a bending potential. We describe hydrodynamic interactions between the beads with the two-wall Green tensor. It was derived by R.B. Jones[2] and takes into account the no-slip boundary condition at the walls.

Brownian dynamics simulations for our model reproduce the same behavior as in experiments, in particular, the bimodal distribution. We demonstrate how velocity of the Poiseuille flow and bending rigidity influence this distribution and also study end-to-end distance and the orientation of the polymer in the microchannel.

[1] D. Steinhauser, S. Köster, H. Stark, and T. Pfohl, submitted.
[2] R.B. Jones, J. Chem. Phys, **121**, 483 (2004).

DY 10.4 Mon 17:00 P4

Folding and unfolding of a triple-branch DNA molecule with four conformational states — •Sandra Engel[1], Anna Alemany[2,3], Nuria Forns[2,3], Philipp Maass[1], and Felix Ritort[2,3] — [1]Fachbereich Physik, Universität Osnabrück, Germany — [2]Departament de Física Fonamental, Universitat de Barcelona, Spain — [3]CIBER-BBN Networking center on Bioengineering, Biomaterials and Nanomedicine, Spain

Single-molecule experiments provide new insights into biological processes hitherto not accessible by measurements performed on bulk systems. We report on a study of the kinetics of a triple-branch DNA molecule with four conformational states by pulling experiments with optical tweezers and theoretical modelling. Three distinct force rips associated with different transitions between the conformational states are observed in the folding and unfolding trajectories. By applying transition rate theory to a free energy model of the molecule, probability distributions for the first rupture forces of the different transitions are calculated. Good agreement of the theoretical predictions with the experimental findings is achieved. Furthermore, due to our specific design of the molecule, we found a useful method to identify permanently frayed molecules by estimating the number of opened basepairs from the measured force jump values.

DY 10.5 Mon 17:00 P4

Cycle-Flux Decompositions of Non-Equilibrium Steady States — •Bernhard Altaner, Jürgen Vollmer, Stephan Herminghaus, and Marc Timme — Max Planck Institute for Dynamics and Self-Organization, 37073 Göttingen

It hat been proposed recently [1] that the currents provide a natural classification of non-equilibrium steady states of Markov processes. This approach does not allow, however, to deal with the entropy (or heat) production rate, which is of considerable interest in biological systems [2]. For this type of questions one can rather consider individual fluxes between adjacent nodes, and decompose the steady state in terms of closed flux cycles. We demonstrate the application of this novel approach using a simple biological membrane model.

[1] R.K.P. Zia & B. Schmittmann, *J Stat Mech: Theo and Exp* **2007** (2007) P07012.
[2] C. Jarzynski, *Eur Phys J B* **64** (2008) 331-340 [Proceedings of StatPhys23].

DY 10.6 Mon 17:00 P4

The impact of a memory trace on the long term routing in complete graphs — •Andre Schuelein, Dimitrije Markovic, and Claudius Gros — Institute for Theoretical Physics, Johann Wolfgang Goethe University, Frankfurt am Main, Germany

Vertex routing models are a recently introduced class of models describing the flow of information within networks via routing processes. The long term information flow in a network given a static routing table is governed by the properties of the existing cyclic attractors. In this poster we investigate the behavior of the cycle length distribution of complete graphs in the case of a memory trace and present analytic mean field approximations for them. Further we show that the cycle length distribution with a memory trace of a complete graph with size N, is very similar to the cycle length distribution without memory trace of a complete graph with size N^2. As a possibility to evaluate the cycle length distribution of bigger graphs we introduce the method of routing on the fly in contrast to the use of static routing tables and highlight their relation. We find a linear mean and median of the cycle length distribution in the case of routing on the fly, in the case of static routing tables the mean and median follow a power law.

DY 10.7 Mon 17:00 P4

Sparse Coding and Self-Sustained Dynamics with Leaky Integrators — •Mathias Linkerhand — Institut für Theoretische Physik der Johann Wolfgang Goethe-Universität, Frankfurt am Main, Germany

Extending the Winner-takes-all paradigm to clique encoding and sparse coding. Considering fully connected random graphs with exhibitory and inhibitory synaptic strengths and changing the intrinsic plasticity to achieve special activity distributions using stochastic adaptation rules. The results will be shown in the poster. . .

DY 10.8 Mon 17:00 P4

Coherent-Potential approximation for noncrystalline structures — •Stephan Köhler[1] and Walter Schirmacher[1,2] — [1]Institut für Physik, Univ. Mainz — [2]Physik-Department E13, TU München

The Coherent Potential Approximation (CPA) has been used extensively in the past decades to calculate properties of disordered solids [1], although its derivation assumes an underlying lattice structure of the material. We present a general method to derive the CPA equations for an amorphous solid using techniques from Quantum field theory. The approach is applied to electrons moving in a spatially fluctuating potential and to diffusion in a material with random diffusion coefficient. The later problem is mathematically equivalent to scalar vibrational excitations (scalar phonons) in a solid with fluctuating sound velocity. The DC-AC crossover in the diffusive dynamics is equivalent to the boson peak anomaly in the vibrational spectrum [2]. Since the CPA equations do not specify the underlying probability distribution of the fluctuations it is possible to study characteristic quantities of disordered solids for different distributions and compare them to results obtained from the Self Consistent Born Approximation [3], which is the low-disorder limit of the CPA. [1] R. J. Elliot et al., Rev. Mod. Phys. 46, 465, (1974); [2] W. Schirmacher, M. Wagener, Philos. Mag. B65, 607 (1992); [3] C. Schirmacher et al., phys. stat. sol. (c) 5, 862 (2008)

DY 10.9 Mon 17:00 P4

Rayleigh scattering, long-time tails, and the harmonic spectrum of topologically disordered systems — •Walter Schirmacher[1,2], Carl Ganter[3], and Stephan Köhler[1] — [1]Institut für Physik, Univ. Mainz — [2]Physik-Department E13, TU München — [3]Institut für Radiologie, TU München

We show rigorously [1] that a topologically disordered system interacting harmonically via force constants, which have a sufficiently short-ranged site-distance dependence, exhibits Rayleigh scattering in the low-frequency limit, i.e. a sound attenuation constant, which is proportional to ω^{d+1}, where ω is the frequency and d the dimensionality. This had been questioned in the literature [2]. The corresponding non-analyticity in the spectrum is related to a long-time tail in the velocity autocorrelation function of the analogous diffusion problem, which varies with time t as $t^{-(d+2)/2}$. A self-consistent theory [1] for the spectrum is formulated, which has the correct analytical properties. [1] W. Schirmacher, C. Ganter, Phys. Rev. B 82, 094205 (2010); [2] T. S. Grigera et al. Nature 422, 289 (2003).

DY 10.10 Mon 17:00 P4

Glassy dynamics of orientation fluctuations in a stripe-forming system — •Christian Riesch., Günter Radons, and Robert Magerle — Institut für Physik, Technische Universität Chemnitz, D-09107 Chemnitz

We present numerical results indicating aging behavior in the orientation fluctuations of a stripe-forming system in the ordered state. We use a simple model which describes phase separation for a conserved order parameter with additional long-range interactions under the influence of thermal noise. It belongs to a class of models describing microdomain formation in block copolymers and other modulated phases, such as thin magnetic films with dipolar interactions. In our simulations, we focus on the dynamics which result from initial conditions of a defect-free ordered state, i.e. a set of parallel stripes. With increasing noise strength η, an order-disorder transition (ODT) occurs at a critical level η_c. Below the ODT, orientation correlation functions (OCF) computed from local stripe orientation depend on both, simulation time t and waiting time t_w. The OCF are found to scale as $C(t,tw) \sim t^{-\nu} \cdot f(t/t_w)$, where the scaling function $f(t/t_w)$ is well described by a stretched exponential.

DY 10.11 Mon 17:00 P4

Non-linear single-particle-response of glassforming systems to external fields — •David Winter[1], Jürgen Horbach[2], Peter Virnau[1], and Kurt Binder[1] — [1]Johannes Gutenberg-Universität, Mainz, Germany — [2]Deutsches Zentrum für Luft und Raumfahrt (DLR), Köln, Germany

Non-equilibrium molecular dynamics (NEMD) computer simulation are used to study the nonlinear response of single particles to external fields in glass-forming soft-sphere mixtures. Individual particles are pulled through the system by applying a constant force. If the force is strong enough, structural rearrangements as well as flow or plastic deformation in the host liquid or glass around the pulled particle will be induced. Force-velocity relations are compared to shear rate-stress relations from NEMD simulations where the non-linear response to macroscopic shear fields is probed. This allows to reveal to what extent the single-particle response to an external force probes the macro-rheological properties of a glass-forming system under shear.

DY 10.12 Mon 17:00 P4

How glassy are biological membranes? — •Sebastian Busch[1], Luis Carlos Pardo[2], and Tobias Unruh[3] — [1]Technische Universität München, Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II) and Physik Department E13, 85748 Garching bei München, Germany — [2]Universitat Politècnica de Catalunya, Grup de Caracterització de Materials, 08028 Barcelona, Catalonia (Spain) — [3]Friedrich-Alexander-Universität Erlangen-Nürnberg, Lehrstuhl für Kristallographie und Strukturphysik, 91058 Erlangen, Germany

Biological membranes surround every cell and are important in pharmaceutical and food industry. Their dynamics is still rather poorly understood: The free volume theory was adapted to the membranes [1] and was a very successful description until it became clear from MD simulations that the molecules exhibit concerted flow-like motions rather than jump-like decaging events [2].

Measuring the self-correlation function of the molecules, the simulations could be supported with quasielastic neutron scattering measurements [3]. The flow-like motions bear a striking resemblance to the dynamical heterogeneities known from glassy dynamics [4].

Which concepts from glass physics can replace the free volume theory for the molecular description of phospholipid dynamics?

[1] W.L.C. Vaz et al., Biophys.J., 60(6):1553, 1991
[2] E. Falck et al., JACS 130(1):44, 2008
[3] S. Busch et al., JACS 132(10):3232, 2010
[4] S. Busch et al., BBA Biomembranes, in print, doi:10.1016/j.bbamem.2010.10.012

DY 10.13 Mon 17:00 P4

Pseudo-Rabi oscillations in dielectric absorption measurements on the glass BK7 at low temperatures — •Gudrun Fickenscher, Manfred von Schickfus, Andreas Fleischmann, and Christian Enss — Kirchhoff-Institut für Physik, Heidelberg University, Germany

The low temperature properties of glasses are to a large extent well described by the phenomenological standard tunnelling model. However, the behaviour of the dielectric function and the decay of the polarisation echo amplitude at temperatures below 50mK are not fully explained. To gain better understanding of the microscopic structure of tunnelling systems and the relaxation mechanisms in glasses, dielectric measurements at temperatures down to a few mK were performed with a Niobium microstrip $\lambda/2$ resonator ($f_{\mathrm{res}} \approx$ 1GHz) structured onto a plate of BK7. We observe the saturation of the dielectric absorption due to resonant tunnelling systems. During the saturation process, we observe surprising low frequency oscillations ($f \approx$ 10kHz) of the resonator transmission whose frequency is proportional to the electric field amplitude as would be expected for Rabi oscillations. They are clearly visible at temperatures from 10 to more than 500mK. However, we would not expect a coherent effect in glasses in this temperature and frequency range since it is known from earlier experiments that the phase relaxation time is below 1 μs at temperatures above 100mK. Experimental data of this phenomenon, which has never been observed in a glass before, will be shown and discussed.

DY 10.14 Mon 17:00 P4

Measurements of the low-frequency elastic properties of dielectric and metallic glasses with double paddle oscillators — •Marius Hempel, Andreas Reiser, Andreas Fleischmann, and Christian Enss — Kirchhoff-Institut für Physik, Im Neuenheimer Feld 227, 69120 Heidelberg

Experimental results of both temperature and frequency dependence of the internal friction and of the change of sound velocity of glasses differ systematically from the predictions of the tunneling model which phenomenologically describes the low temperature properties of glasses. Mutual interaction of the tunneling states which is not incorporated in the tunneling model has been discussed as a possible explanation.

We investigated the elastic properties of the bulk metallic glass

$Zr_{55}Cu_{30}Al_{10}Ni_5$ and of the dielectric optical glass N-KZFS11. The dielectric glass and metallic glass in the superconducting state ought to yield a similar behaviour.

The samples are driven and read out capacitively. They are placed within a solenoid of superconducting niobium-titanium wire providing a magnetic field. The samples feature a double paddle oscillator geometry which exhibits very small background damping due to clamping compared to the vibrating reed method.

The sound velocity and the internal friction at frequencies between 0.5 and 7.5 kHz down to a temperature of 6 mK have been measured. We present experimental results of the different glasses and compare them to theoretical predictions.

DY 10.15 Mon 17:00 P4

Thermal Conductivity of Superconducting Bulk Metallic Glasses at Very Low Temperatures — •Daniel Rothfuss[1], Uta Kühn[2], Andreas Fleischmann[1], and Christian Enss[1] — [1]Kirchhoff-Institute for Physics, Heidelberg University, INF 227, 69120 Heidelberg — [2]IFW Dresden, Institute for Complex Materials, P.O. Box 270116, 01171 Dresden

As a new kind of vitreous material bulk metallic glasses offer several advantages for the investigation of glassy materials at very low temperatures. Particularly with superconducting bulk metallic glasses it is possible to probe not only the interaction between tunnelling systems and electrons, but also with phonons by switching between the normal and superconducting state with an external magnetic field. But until now only little is known about their properties down to milli-kelvin temperatures. The only existing measurements of thermal conductivity of bulk metallic glasses do not reach much below 1K or are performed on thin films down to 100mK. We present the thermal conductivity of bulk amorphous $Zr_{52,2}Ti_5Cu_{17,9}Ni_{14,6}Al_{10}$ in the superconducting state down to 6mK. Measurements were performed with a novel SQUID-based contact free technique because of its extremely small parasitic heating. Our results show that the thermal conductivity of the sample scales nearly quadratically with temperature. This suggests that sufficient below the critical temperature the thermal conductivity of this bulk metallic glass can be described well by the thermal diffusion of phonons and their resonant scattering at tunnelling systems.

DY 10.16 Mon 17:00 P4

Translational Granular Brownian Motor — •Chih-Wei Peng, Max Neudecker, Nabiha Saklayen, Johannes Blaschke, Jürgen Vollmer, and Matthias Schröter — Max-Planck-Institut für Dynamik und Selbstorganisation, Göttingen, Germany

We construct a motor driven by the random motion of granular particles. In this setup, a wedge, which is allowed only translational freedom along one axis, is placed in granular gas. According to the idea of brownian motor, the time reversal symmetry-breaking due to the inelastic collisions between particles and wedge along with the symmetry breaking of rotational invariance implies that the wedge could have a preferred drift direction[1]. In addition, we also consider the effect due to the anisotropy of particle velocity distribution on different axes, which could largely change the drift velocity.

References

[1] Cleuren, B. and Van den Broeck, C. Europhys. Lett. 77, 50003 (2007).

DY 10.17 Mon 17:00 P4

Condensation time scale of a stochastic transport process with pair factorized steady states — •Hannes Nagel[1], Bartlomiej Waclaw[2], and Wolfhard Janke[1] — [1]Institut für Theoretische Physik, Universität Leipzig, Germany — [2]School of Physics & Astronomy, The University of Edinburgh, UK

Stochastic transport processes (such as [1]) can be tuned by their generating weight functions to exhibit a steady state with a condensate of particles that is separate from a fluid background phase. We study the dynamics of the relaxation into the steady state of such driven transport systems using numerical simulations to determine the condensation time scale and discuss the corresponding phenomenologic mechanisms. Despite the existence of short-range interactions in the studied system, the condensation behavior is found to be quite similar to that of the zero-range process on one- and two-dimensional lattices.

[1] M. R. Evans, T. Hanney, and S. N. Majumdar, *Interaction driven real-space condensation*, Phys. Rev. Lett. **97** (2006) 010602-1–4
[2] H. Nagel, *Mass Condensation in Stochastic Transport Processes and Complex Networks*, Diploma thesis, Leipzig (2010)

DY 10.18 Mon 17:00 P4

General relation between signal attenuation from gradient nuclear magnetic resonance and distribution of diffusivities from single-molecule tracking in diffusion processes — •Michael Bauer[1], Günter Radons[1], Rustem Valiullin[2], and Kärger Jörg[2] — [1]Chemnitz University of Technology, Germany — [2]University of Leipzig, Germany

Diffusion processes in heterogeneous environments appear in many physical and biological applications, for instance in ultra-thin liquid films. Liquid layering leads to a change of diffusion properties and induces heterogeneities in the observed motion of tracer molecules. In order to characterize processes observed by single-molecule tracking (SMT) we suggested to investigate the distribution of diffusivities and their dependence on observation time [1]. This technique provides advantages over conventional methods such as mean-squared displacements, which conceal the effects of inhomogeneities. In our contribution we extend the investigations to ensemble-based measurements obtained from pulsed field gradient nuclear magnetic resonance (PFG NMR). Our objective is to relate the signal attenuation of PFG NMR, which corresponds to the propagator in Fourier space, to the distribution of diffusivities [2]. We derive analytical expressions and illustrate the applicability of this approach by the well-established two-region exchange model known from PFG NMR studies. Furthermore, our method provides a promising approach to investigate ergodicity of such systems.

[1] M. Bauer et al., diffusion-fundamentals.org 11, 104 (2009)
[2] M. Bauer et al., J. Chem. Phys., submitted (2010)

DY 10.19 Mon 17:00 P4

1D Schrödinger equation with open boundaries for pumping potentials — •Niklas Rohling and Frank Grossmann — Institut für Theoretische Physik, Technische Universität Dresden, D-01062 Dresden, Germany

In order to generate a non-vanishing average current within the time-periodic Schrödinger equation the potential has to break parity and generalized parity. We therefore firstly consider the following potentials with position-dependence only in a central region and a non-static bias: a harmonically driven sawtooth potential (a) and a step-like potential (b). Secondly, we study a dipole field in the central region (c). The cases (b) and (c) contain driving by the fundamental and the second harmonic, so-called harmonic mixing [1]. To calculate the current, we use Floquet scattering theory as well as an open boundary wavefunction [2]. In case (c) we optimize the relative amplitude ratio between the fundamental and the second harmonic leading to a maximum in the pumping current.

[1] S. Kohler, J. Lehmann, and P. Hänggi, Phys. Rep. **406** 379-443 (2005)
[2] S. Kurth, G. Stefanucci, C.-O. Almbladh, A. Rubio, and E. K. U. Gross, Phys. Rev. B **72**, 035308 (2005)

DY 10.20 Mon 17:00 P4

Calculation of the diffusion coefficient of disordered systems by using the building block principle — •Arzu Bahar Yener and Stefanie Russ — Freie Universitaet Berlin

The self-diffusion coefficient D_s for linear diffusion on lattices and in pores in the Knudsen regime is calculated by the method of random walks for disordered systems, where the mean square displacement $\langle x(t) \rangle$ consists of the quadratic term and the correlation term. To this end, a building-block principle is applied that composes the system into substructures i ("building blocks") without cross correlations between them. We present different substructures for lattices whose correlation terms are calculated either analytically or numerically as simply as possible. For the latter, methods are revealed that allow to obtain the correlation terms of each substructure numerically with low costs. Finally, we show, how the correlation terms of the different substructures must be combined to find D_s of the total lattice. The results are verified numerically for lattices as well as for realistic pores.

DY 10.21 Mon 17:00 P4

Molecular dynamics simulation of hot Brownian motion — •Dipanjan Chakraborty[1,2], Daniel Rings[1], Frank Cichos[2], and Klaus Kroy[1] — [1]ITP, University of Leipzig, Germany — [2]EXP-I, University of Leipzig, Germany

We present a molecular dynamics (MD) study of "hot Brownian motion", a scenario in which a nanoparticle is kept at an elevated temperature with respect to the ambient fluid. This situation is experimentally realized when a light-absorbing tracer particle diffuses in the focus of a laser. Because of the separation of time scales between heat propagation and Brownian motion, a steady temperature profile develops around the nanoparticle, which can be detected by a second laser [1]. Our MD simulations are used to investigate various microscopic phenomena associated with "hot Brownian motion", including effective temperatures and non-equilibrium hydrodynamic boundary conditions. The results are compared to recent analytical predictions obtained from fluctuating hydrodynamics [2].

[1] R. Radünz, D. Rings, K. Kroy, and F. Cichos, J. Phys. Chem. A 113 (9), 1674-1677 (2009)
[2] D. Rings, R. Schachoff, M. Selmke, F. Cichos, and K. Kroy, Phys. Rev. Lett., 105 (9), 090604 (2010)

DY 10.22 Mon 17:00 P4

Anomalous diffusion of Brownian particals in potential traps exposed to shear flow — •Johannes Greber, Diego Kienle, Jochen Bammert, and Walter Zimmermann — Universität Bayreuth, LS für theoreitsche Physik I, 95440 Bayreuth

The Brownian motion of particles in various potential shapes is investigated. Depending on the local curvature of potentials with a single minimum, we find either sub- or super-diffusive particle dynamics. The dependence of the anomalous exponent of the mean square displacement on the on the potential shape is explored. In addition, we study also the impact of shear flow on the diffusive behavior of particles in potentials, as recently investigated for small excursions in Ref. [1]. In addition , we study the dynamics of particles in a double well-potential well, where the particles are exposed to shear flow. As well, we find a nonlinear shear rate dependence of the probability current across the potential.

[1] A. Ziehl et al., Phys. Rev. Lett. 103, 230602 (2009)

DY 10.23 Mon 17:00 P4

Anomalous diffusion in crowded fluids revealed by a novel single-particle tracking technique — •Dominique Ernst[1], Marcel Hellmann[3], Matthias Weiss[2], and Jürgen Köhler[1] — [1]Experimental Physics IV, University of Bayreuth, 95440 Bayreuth, Germany — [2]Experimental Physics I, University of Bayreuth, 95440 Bayreuth, Germany — [3]Cellular Biophysics Group, German Cancer Research Center, 69120 Heidelberg, Germany

A versatile setup for automated single particle tracking in two dimensions is used to analyse anomalous diffusion processes in crowded fluids with a high spatio-temporal resolution. The ingenious tracking technique allows us to record trajectories of a single fluorescent nanoparticle (20 nm) for more than 15 minutes with a temporal resolution of 4 ms and a dynamic position accuracy of about 25 nm. We create a light orbit with a focussed laser beam and project that light orbit with a homebuilt fluorescence microscope into the sample plane. At the beginning of the tracking procedure, the nanoparticle has to be located in the center of the orbit. Subsequently, we detect the modulation of the emission intensity due to the movement of the particle out of the center of the light orbit, calculate the new position of the particle from the modulation parameters, and compensate for the movement of the particle with the aid of a piezostage. From that feedback we reconstruct the trajectory of the particle and determine the mean square displacement. Here we present the method and as an example its application to diffusion in crowded fluids like dextran as a model system for the cytoplasm of a cell.

DY 10.24 Mon 17:00 P4

Analyzing anomalous diffusion processes: the distribution of generalized diffusivities — •Tony Albers and Günter Radons — Chemnitz University of Technology, Germany

We propose a new tool for analyzing data from normal or anomalous diffusion processes: The distribution of generalized diffusivities $p_\alpha(D,\tau)$ is defined as the probability density of finding a squared displacement of duration τ, rescaled by its asymptotic time dependence τ^α. It describes the fluctuations appearing during the diffusion process around the mean anomalous diffusion coefficient, which can be obtained from the asymptotic behavior of the mean squared displacement (MSD) and is also equal to the first moment of the distribution $p_\alpha(D,\tau)$ for large τ. In comparison with the MSD we therefore obtain more information from the numerically or experimentally determined data. In this contribution we analyze with this new tool the diffusive transport in low and higher dimensional Hamiltonian systems and show with the help of modified continuous time random walks how the structures in phase space are reflected in the distribution of generalized diffusivities.

DY 10.25 Mon 17:00 P4

Diffusion in komplementären Strukturen — •Thorsten Emmerich[1] und Armin Bunde[2] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität 35392 Giessen — [2]Institut für Theoretische Physik, Justus-Liebig-Universität 35392 Giessen

Wir untersuchen mit Hilfe der Monte Carlo Simulation Diffusion in komplementären Räumen. Ziel ist es, herauszufinden, in wie weit man von der Diffusion in einem nanoporösen System auf die Diffusion im komplementären Porensystem schließen kann. Um experimentell relevante Porenstrukturen zu erzeugen, verwenden wir das Isingmodell mit Kawasaki-Spinaustausch. Um die gewünschte Porenstruktur zu erzeugen, wird bei vorgegebener Spin-up-Konzentration p das System auf eine Temperatur $T < T_c$ abgekühlt. Dabei bilden sich Domänen mit gleicher Spinausrichtung (Cluster). Die Porengröße der Cluster kann durch unterschiedliche Relaxationszeiten τ verändert, und durch die räumliche Spin-Spin Korrelationsfunktion quantifiziert werden. Wir bestimmen mit Hilfe von Monte Carlo Simulationen die Diffusionseigenschaften (mittleres Verschiebungsquadrat als Funktion der Zeit) des Systems und des komplementären Systems, sowohl in der Nähe als auch fern der Perkolationsschelle p_c. Ausser Volumendiffusion betrachten wir auch reine Grenzflächendiffusion, wo sich die diffundierenden Teilchen nur auf der Grenzfläche des jeweiligen Systems bewegen können. Wir diskutieren die Bedingungen unter denen die Diffusionseigenschaften in den komplementären Räumen einander ähnlich sind.

DY 10.26 Mon 17:00 P4

Are superdiffusive jumps in molecular diffusion triggered or destroyed by the chaotic dynamics of the molecule's internal degrees of freedom? — •Sarah Hallerberg[1] and Astrid S. de Wijn[2] — [1]Chemnitz University of Technology — [2]Radboud University Nijmegen

Long jumps in surface diffusion of organic molecules and nanoscale clusters have been observed experimentally, and were also found in numerical simulations. Recent studies[1] highlight the existence of a relation between the diffusion of molecules and the dynamics of their internal degrees of freedom. These internal chaotic dynamics lead to normal diffusion, even in the absence of thermal noise. Our contribution aims at determining the physical mechanism which trigger long superdiffusive jumps. Benzene on graphite is a prototype system and serves us to investigate these long jumps by postprocessing the output of atomistic simulations[1]. In more detail, we search for precursors[2] in the internal degrees of freedom by considering the energy in the vibrational modes of the linearised system and show that relevant precursors appear particularly in the torsional vibrations. Our results suggest a strong connection between lack of torsion of the molecule and long superdiffusive jumps.

[1] A. S. de Wijn and A. Fasolino. Journal of Physics: Condensed Matter, 21:264002, 2009. [2] S. Hallerberg, E. G. Altmann, D. Holstein, H. Kantz, Phys Rev. E, 2007, 75, 016706.

DY 10.27 Mon 17:00 P4

Anomalous magnetoresistance in a 2D Lorentz-Gas — •Benedikt Fuchs[1], Teresa Bauer[1], Felix Höfling[2], and Thomas Franosch[3] — [1]ASC and CeNS, Fakultät für Physik, Ludwig-Maximilians-Universität München, Germany — [2]Max-Planck-Institut für Metallforschung, Stuttgart, and Institut für Theoretische und Angewandte Physik, Universität Stuttgart, Germany — [3]Institut für Theoretische Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

We simulate the transport of electrons through a two-dimensional random array of obstacles under the influence of a perpendicular magnetic field. At low density, a percolation transition arises, at which transport sets in. It can be rationalized as follows: For fixed magnetic field, the electrons circle around few obstacles and stay near their starting point at very low density, while they proceed from one obstacle to the next at intermediate density, traversing the whole system for sufficiently dense obstacles. This transition and the dependence of the critical density on the magnetic field have been anticipated before [1], but have yet never been verified in a simulation. We examplify the transition at several points, corrobating the predicted behavior. Anomalous transport is observed at these points for more than six orders of magnitude in time by both power-law behaviour of the MSD and power-law decay of the diffusion coefficient.

[1] A. Kuzmany and H. Spohn, Phys. Rev. E 57(5), 5544 (1998)

DY 10.28 Mon 17:00 P4

Determination of the attractor dimension at the synchronization transition of a delayed chaotic system — •Steffen Zeeb and Wolfgang Kinzel — Institut für Theoretische Physik, Universität Würzburg

A network of nonlinear units interacting by time-delayed couplings can sychronize to a common chaotic trajectory. Although the transmission time may be very long the units are completely synchronized without time shift.

We investigate the transition to synchronization. In particular, for networks of iterated maps we determine the Kaplan-Yorke dimension from the spectra of Lyapunov exponents which are calculated analytically for Bernoulli maps and numerically for tent maps. However, we argue that the Kaplan-Yorke conjecture cannot be true at the transition. For the synchronized state the Lyapunov exponents perpendicular to the synchronization manifold cannot contribute to the attractor dimension. Consequently, the attractor dimension has to jump discontinuously at the transition. We calculate the magnitude of this jump for different networks.

Finally, the Kaplan-Yorke dimension is compared to the information and correlation dimension, respectively, in order to check the discontinuous behavior of the attractor dimension.

DY 10.29 Mon 17:00 P4

Emergence of coherent motion in flocks of deterministics walkers: a coupled maps evolving network perspective — Garcia Cantu Ros Anselmo[1], Basios Vasileos[2], and •Antonopoulos Christos[2] — [1]Potsdam Institute for Climate Impact Research PIK, Potsdam, Germany — [2]Free University of Brussels ULB, Brussels, Belgium

The emergence of coherence in collective motion described by a system of interacting motiles is analyzed. By means of a nonlinear adaptative coupling, the system elements are able to swing along the route to chaos. Thereby, each motile can display different types of behavior, i.e. from ordered to fully erratic motion, accordingly with its surrounding conditions. The appearance of patterns of collective motion is shown to be related to the emergence of interparticle synchronization and the degree of coherence of motion is quantified by means of a network representation. It is shown that the highest degree of coherence of motion is attained when the system self-drives towards the border between order and chaos. The effect of both particles' density and of considering different weights for the interparticle distances is explored.

DY 10.30 Mon 17:00 P4

Information Spread during Building Evacuation Scenario with Long and Short-range Communication — •Mirko Kämpf and Jan W. Kantelhardt — Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, 06099 Halle/Saale, Germany

Based on extended lattice-gas simulations with additional short-range and long-range interactions we study the spread of information between human agents during a large-scale building evacuation scenario. Our evacuation simulation tool utilizes established algorithms for the emotional and intelligence driven motion of human beings in a building and includes direct (short-range) as well as communication technology enabled (long-distance) information spread between them. We compare our results with those from simulations in an unrestricted geometry (free space) and for varying prevalence of long-distance communication. This way we study the impact of futures communication technologies on effective exit strategies during emergency evacuation. To detect phases (steady flow, panic, jam, etc.) and phase transitions in the system we apply detrended fluctuation analysis and return interval statistics to the simulation data. The results help us to define basic functional requirements for the underlying communication and network topology as well as to needed sensors.

DY 10.31 Mon 17:00 P4

Synchronization of chaotic networks and the spectral gap of stochastic matrices — •Martin Paulig and Wolfgang Kinzel — Institute for Theoretical Physics, University Würzburg, Am Hubland, 97074 Würzburg, Germany

A network of coupled nonlinear units can synchronize to a common chaotic trajectory. Although the coupling may have a long time delay, synchronization occurs without any time shift. In the limit of very large delay time, the spectral gap of the coupling matrix determines the condition for a stable synchronization manifold. On the other side, the theory of stochastic matrices gives conditions for a nonzero spectral gap. From this relation, we calculate the parameter regions of stable synchronization for various networks with uni- and bi-directional couplings.

DY 10.32 Mon 17:00 P4

Master stability function for time-delayed networks of chaotic semiconductor lasers — •Sven Heiligenthal, Anja Englert, Marco Winkler, and Wolfgang Kinzel — Julius-Maximilians-University, Würzburg, Germany

The master stability function allows to calculate the stability of the synchronization manifold of arbitrary networks. We use this method to numerically analyze the stability of several different networks of chaotic semiconductor lasers with time-delayed mutual couplings by simulating the Lang-Kobayashi equations.

We make predictions about the synchronizability of such networks by relating the modulus of the second largest eigenvalue of the network's adjacency matrix to the maximal Lyapunov exponent of the network dynamics. Our numerical simulations confirm these predictions for two examples of different network topologies.

Furthermore, we show symmetries of the master stability function for networks with two different delay times which were recently proven for networks of simple Bernoulli maps. Our numerical results for networks of chaotic semiconductor lasers show these symmetries, as well.

Finally, we show by using the master stability function that networks of chaotic semiconductor lasers in which the delay time of the mutual couplings is much larger than the internal time scales of the chaotic lasers cannot be synchronized if the local Lyapunov exponent is positive. We also make a proposal for an experimental method which can measure this local Lyapunov exponent.

DY 10.33 Mon 17:00 P4

A dynamical model of controlled nanochannel lattice formation utilizing prepatterned substrates — •Michael H. Köpf, Svetlana V. Gurevich, and Rudolf Friedrich — Institut für Theoretische Physik, Universität Münster

Self-organized processes in dewetting systems provide effective methods for the controlled fabrication of micro- and nanostructured surfaces. Lipid monolayers such as DPPC and DMPE are known to form regular stripe patterns upon Langmuir-Blodgett transfer onto solid substrates [1]. These patterns consist of alternating domains of different thermodynamic phases and result from phase transitions induced by a substrate-monolayer interaction. By incorporation of the monolayer thermodynamics into a hydrodynamic model of thin film flow, this process can be described in terms of two coupled nonlinear partial differential equations [2,3]. Here, we present a theoretical study of the effect of prepatterned substrates, focussing on periodic prestructures. These structures lead to a periodic forcing of the pattern formation at the meniscus. Synchronization with this forcing can be exploited to generate complex periodic structures in a controlled manner [4].

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DY 10.34 Mon 17:00 P4

Pattern deposition in driven lattices — •Benno Liebchen, Christoph Petri, Florian Lenz, and Peter Schmelcher — Zentrum für optische Quantentechnologien, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

The nonlinear dynamics of classical, noninteracting particles in a one-dimensional lattice of laterally driven square potentials is studied, by means of exact numerical simulation.

We demonstrate two different mechanisms for the creation of controllable pattern-like particle-localization. Apparently, this is not possible in a system of static barriers, since trapping would prohibit the coexistence of diffusion there. By instantly increasing the barrier-potential in a periodic lattice with nonlinear phase-gradients, we observe the development from a uniform particle-distribution to a pattern-like structure. The mechanism is explained by symmetry considerations. Within a lattice with spatially varying barrier-frequency, transient global patterns are created and frozen via an instant increase of the barrier-potential.

DY 10.35 Mon 17:00 P4

Plasticity in a Spiking Neural Network Model — •Cornelia

Petrovic and Rudolf Friedrich — Westfälische Wilhelms-Universität Münster, Institut für Theoretische Physik

We study the influence of spike-timing-dependent plasticity (STDP) in a spiking neuronal network which consists of pulse-coupled phase oscillators introduced by Haken as the lighthouse model [1]. It is a single neuron model that falls between spiking neuron models and firing rate descriptions and thus combines "best of both worlds". In the limit of slow synaptic interactions it can be reduced to the classic Wilson-Cowan and Amari type firing rate models [2,3,4]. For fast synaptic dynamics, it shows some of the complex properties of spiking neural networks.

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DY 10.36 Mon 17:00 P4

Where can one observe non-hyperbolicity? — •Jian Wang, Hongliu Yang, and Günter Radons — Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany

Hyperbolicity is an important property of dynamical systems. Many physically relevant dynamical systems are not hyperbolic, and many of the available theoretical results have been derived under the assumption of strict hyperbolicity. Recently, a new method for determining the so-called covariant Lyapunov vectors (CLV) was introduced by F. Ginelli et al. With CLV the degree of hyperbolicity of the dynamics can be quantified. Since in a non-hyperbolical system the violation of hyperbolicity occurs only at certain locations in state space, the determination of these locations is of much interest. In this study we investigate the relationship between hyperbolicity and the covariant Lyapunov analysis along the trajectory. Our main focus lies on the relation of angles between different local CLV to the variation of local Lyapunov exponents. The positions, where non-hyperbolictiy arises, are shown.

DY 10.37 Mon 17:00 P4

Continuous path-based measures for ε-recurrence networks — •Jonathan F. Donges[1,2], Jobst Heitzig[1], Reik V. Donner[1], and Jürgen Kurths[1,2] — [1]Potsdam Institute for Climate Impact Research, P.O.Box 60 12 03, 14412 Potsdam, Germany — [2]Department of Physics, Humboldt University of Berlin, Newtonstr. 15, 12489 Berlin, Germany

Continuous versions of various path-based graph-theoretical measures are defined for ε-recurrence networks, which have recently been successfully used in various applications of dynamical systems theory and time series analysis. We derive closed form expressions for two well-known one-dimensional maps as well as for the hypersphere and hypercube in various dimensions m. The latter problems are found to be closely linked to current research in probabilistic geometry and applied mathematics. Some comparison of the rigorous results to numerical estimates from ε-recurrence networks of finite length time series is also made. We argue that the proposed theory of path-based ε-recurrence network measures contributes substantially to a deeper understanding of the method of ε-recurrence network based time series analysis, which has already been utilized successfully in several distinct applications. Some geometrical applications of these measures, e.g., to define well-behaved measures of the convexity of a set, are also suggested.

DY 10.38 Mon 17:00 P4

State switching in a conductance-based cortical model: phase diagram and pulse stimulation — •Arne Weigenand, Thomas Martinetz, and Jens Christian Claussen — Neuro- and Bioinformatik, Universität zu Lübeck

A recent experiment [1] investigated the on- and off switching of bursting activity in ferret brain slices. This experiment is seen as a paradigmatic system towards the understanding of the emergence of cortical slow waves. The basic dynamics can be modeled by a simplified discretized integrate - and - fire model having intrinsic inhibitory currents but lacking inhibitory connections [2]. Here we use a conductance-based model to reproduce the spike-burst dynamics and the triggering of Up states as observed in [1]. Finally we investigate the phase diagram of the qualitatively different network states depending on the coupling strength and network noise intensity [3].

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DY 10.39 Mon 17:00 P4

Spiral Defect Chaos in Rayleigh Benard Systems — •Hira Affan and Rudolf Friedrich — Westfälische Wilhelms Universität Münster

The importance of mean flow is addressed in a system of Rayleigh Benard Convection. A numerical study is carried out to investigate the model equations so that it can be argued that mean flow is important for the spiral defect chaos.

DY 10.40 Mon 17:00 P4

Synchronisation in networks of delay-coupled type-I excitable systems — Andrew Keane, •Thomas Dahms, Judith Lehnert, Philipp Hövel, and Eckehard Schöll — Institut f. Theo. Physik, Sekr. EW 7-1, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

We use a generic model for type-I excitability (known as the SNIPER or SNIC model) to describe the local dynamics of nodes within a network and apply time-delayed coupling as a means of control to stabilise the synchronised dynamics. Utilising the method of the master stability function, we investigate the stability of the synchronised dynamics (i.e. the success of the control) and its dependence on the two coupling parameters, namely the coupling strength and delay time. The results are compared to numerical simulations for exemplary cases (including random networks and small-world networks). It is shown that for particular parameter ranges the results are comparable to previous work with the FitzHugh-Nagumo model (a model for type-II excitability), while for other parameter values the stability of synchronisation will depend on the coupling strength and delay time.

DY 10.41 Mon 17:00 P4

Spatial instability in diffusive system with variable delay — •Jian Wang and Günter Radons — Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany

In ubiquitous natural and laboratory situations the action of time delayed signals is a crucial ingredient to understand the dynamical behavior of these systems. A frequently encountered situation is that the length of the delay time changes with time. With the introduction of varying delay, a simple system can exhibit complicated behavior. In this study we investigate spatial diffusive system with variable delay and show that the spatial instability increases with the introduction of varying delay. Lyapunov exponents and dynamic structure factor are calculated. Special space-time structures, such as travelling wave, are investigated in some detail.

DY 10.42 Mon 17:00 P4

Diffusive Coupling Can Discriminate Between Similar Reaction Mechanisms in an Allosteric Enzyme System — •Ronny Straube[1] and Ernesto M. Nicola[2] — [1]Systems Biology Group, Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany — [2]Institute for Cross-Disciplinary Physics and Complex Systems, Campus UIB, Palma de Mallorca, Spain

Recently, inward rotating spiral waves (anti-spirals) have been observed in cell free yeast extracts [1]. Such anti-spirals were, so far, only observed in purely chemical systems. To elucidate the molecular mechanism leading to this unusual wave dynamics we compare two mechanisms of product activation for the allosteric enzyme phosphofructokinase. We find that a sequential activation mechanism as in the Monod-Wyman-Changeux (WMC) model is able to generate inward propagating waves while a simple Hill function as employed in the Selkov model is not [2]. The occurrence of inward propagating waves is related to the sensitivity of the enzyme cooperativity with respect to the activator concentration, and we show that the waves generated by the MWC mechanism are more stable against long wave length perturbations. These results explicitly show how the type and the stability of macroscopically observable wave patterns depend on the underlying molecular reaction mechanism in a simple allosteric enzyme system.

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DY 10.43 Mon 17:00 P4

Evolution of a scroll ring in an oscillatory medium close to

a Neumann boundary — •Fabian Paul and Harald Engel — Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstr. 36, D-10623 Berlin, Germany

It is shown that scroll ring solutions of the complex Ginzburg-Landau equation can be stabilized by the interaction with a Neumann boundary. Two antagonistic tendencies govern the dynamics of the scroll ring: Boundary-induced expansion and contraction caused by positive filament tension. Depending on the initial conditions and the chosen parameters, due to the interaction with the Neumann boundary the contraction of the scroll ring is slowed down or even terminated at a finite radius. For certain parameter values numerical simulations suggest a limit cycle regime with alternating phases of contraction and expansion of the scroll ring. This object reminds of an autonomous pacemaker in an active medium close to the transition between excitable and oscillatory kinetics.

DY 10.44 Mon 17:00 P4

Predicting Outliers in Ensemble Forecasts — •Stefan Siegert, Jochen Bröcker, and Holger Kantz — Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

An ensemble forecast is a collection of runs of a numerical dynamical model, initialized with perturbed initial conditions. In modern weather prediction for example, ensembles are used to retrieve probabilistic information about future weather conditions. In this contribution, we are concerned with ensemble forecasts of a scalar quantity (say, the temperature at a specific location), and their relation to the verification (i. e. the actual observation of that quantity). We consider the event that the verification is smaller than the smallest or larger than the largest ensemble member. We call these events *outliers*. If a K-member ensemble accurately reflects the variability of the verification, outliers should occur with a relative frequency of $2/(K+1)$. In operational forecast ensembles though this frequency is often found to be higher. We study the predictability of outliers and find that, exploiting information available from the ensemble, forecast probabilities for outlier events can be calculated which are more skillful than the unconditional relative frequency. In other words, using ensemble information, more accurate forecasts of impending outliers are possible than just stating their relative frequency. We show this analytically for statistically consistent ensembles and empirically for an operational ensemble using methods of model output statistics. Our results are relevant for evaluating and post-processing ensemble forecasts.

DY 10.45 Mon 17:00 P4

Drawing energy landscapes of spin glasses — •Karsten Looschen and Alexander Hartmann — Carl von Ossietzky Universität Oldenburg, Institut für Physik, D-26111 Oldenburg

The rough energy landscape of a spin glass is regarded as one of its main features, but how does it look like? Often a schematical sketch with a one dimensional arrangement of states is drawn, however for a spin glass of N Ising spins the energy landscape consists of 2^N states in a N-dimensional space. We propose different algorithms to systematically retrieve a meaningful arrangement of states.

Since enumeration of all states is impossible for all but very small systems, some (10^3 - 10^5) states are statistically sampled. Efficient hierarchical clustering algorithms based on a similarity measure for the sampled states can be used to alleviate the problem of high dimensionality. Leafs which are near each other in the resulting tree represent states with high similarity. This feature of the tree enables a simple plot of the energy landscape with a one dimensional arrangement of states.

The three dimensional Edwards-Anderson $\pm J$ spin glass with bond strengths $-J$ (probability p) and $+J$ (probability $1-p$) is examined. This system is a spin glass if $0.23 < p < 0.77$ and a ferromagnet else. Graphical representations of its energy landscape are retrieved and the "roughness" is characterized as a function of p.

DY 10.46 Mon 17:00 P4

Large-scale transitions in Plio-Pleistocene African dust flux dynamics identified by recurrence network analysis — Jonathan F. Donges[1,2], •Reik V. Donner[1], Martin H. Trauth[3], Norbert Marwan[1], and Jürgen Kurths[1,2] — [1]Potsdam Institute for Climate Impact Research, Potsdam, Germany — [2]Department of Physics, Humboldt University of Berlin, Germany — [3]Department of Earth and Environmental Sciences, University of Potsdam, Germany

These days, long-term environmental changes are believed to have acted as a key factor in the evolutionary history of the human race. For the Plio-Pleistocene climate history of East Africa (the "cradle of mankind"), recent studies on terrestrial as well as marine paleoclimate archives suggested different possible climatic forcing mechanisms. Here, we apply recurrence network analysis, a novel nonlinear statistical technique, to three distinct marine records of terrigeneous dust flux. Our method identifies subtle, but robust transitions between qualitatively different types of dust flux dynamics at about (i) 3.45-3.05, (ii) 2.1-1.7, and (iii) 1.2-0.7 Myr BP, which reflect changes in the variability of environmental conditions in North and East Africa. The timing of the identified transition periods reveals both low- and high-latitude climatic changes as possible dynamic origins of the observed regime shifts, the sources of which are identified and critically discussed.

DY 10.47 Mon 17:00 P4

Towards first-passage-time prediction for temperature data — •Anja Garber, Nicholas Moloney, and Holger Kantz — Max-Planck-Institut für Physik komplexer Systeme, Dresden

In the operational short term weather prognoses, detailed models are run only for a lead time of ten days, preventing predictions further into the future. However, in the more medium range exceeding the lead time of model runs where detailed predictions are currently unavailable, already the first passage time until a threshold crossing can be of significant interest, e.g. the expected time until first frost.

In order to develop methods towards a suitable approximation and prediction of these first passage times from the existing model runs, we study the first passage time distribution both for an autoregressive model process and actual temperature data.