DY 62: Poster - Dynamics

Nonlinear Dynamics, Synchronization and Chaos; Delay and Feedback Dynamics; Pattern Formation Modelling of non-linear dynamics in biological movement; Granular Matter /Contact Dynamics

Time: Thursday 16:00–18:00 Location: Poster A

DY 62.1 Thu 16:00 Poster A

Ergodicity criterion for small Hamiltonian systems — •Patrick Pietzonka and Udo Seifert — II. Institut für Theoretische Physik, Universität Stuttgart

We study the long-time behavior of Hamiltonian systems in the context of a formalism developed by H. Mori, R. Zwanzig and M. H. Lee (MZL) [1]. This formalism leads to the representation of autocorrelation functions of dynamical observables as infinite continued fractions. From the convergence properties and the analysis of these mathematical constructs we derive a simple formulation of an ergodicity criterion. We illustrate this criterion by applying it to non-linear oscillators and short chains of non-linearly coupled particles. These examples require the numerical computation of a large number of continued fraction coefficients.

Our approach reveals some general limits of the MZL formalism for certain classes of correlation functions. To overcome these limits we suggest a generalization that may lead to better approximations of correlation functions and entail a refined ergodicity criterion.

[1] M. H. Lee, Phys. Rev. Lett. **49**, 1072 (1982)

DY 62.2 Thu 16:00 Poster A

A prototype dynamical system with a generalized mechanical potential — •Bulcsú Sándor and Claudius Gros — Institut für Theoretische Physik, Goethe Universität, Frankfurt am Main, Germany

In dynamical systems theory, prototype systems are often used to investigate different bifurcation scenarios or certain dynamical behaviours. Systems, like the van der Pol oscillator, the Takens-Bogdanov system, or the Rössler system, are considered to be prototypical examples for the birth of limit cycles, homoclinic and period doubling bifurcations respectively, but leave little or no possibility to be reshaped for exploratory purposes while keeping their major dynamical features unchanged. Thus, one would sometimes like to design simple systems with predefined properties to understand the bifurcations of systems with higher complexity.

In this work a new class of prototype systems is proposed, which provides a mechanistic understanding for many different dynamical behaviours, including the previously mentioned bifurcations. We introduce a generalized mechanical potential which allows the local minima to be placed at arbitrary locations. Together with a velocity dependent force term one can easily control the flow through the parameters, by changing the balance between energy uptake and dissipation along the trajectory. Increasing the dimensionality of the system a whole cascade of limit cycle bifurcations is revealed, culminating in a period-doubling route to chaos.

DY 62.3 Thu 16:00 Poster A

Transient dynamics reveal network connectivity — •Jose Casadiego[1,3] and Marc Timme[1,2,3] — [1]Network Dynamics, Max Planck Institute for Dynamics and Self-Organization, 37077 Göttingen, Germany — [2]Institute for Nonlinear Dynamics, Faculty of Physics, University of Göttingen, 37077 Göttingen, Germany — [3]IMPRS Physics of Biological and Complex Systems, Göttingen Graduate School for Neurosciences, Biophysics and Molecular Biosciences, 37077 Göttingen, Germany

Determining the physical structure of interactions within a network poses a great challenge to date. Still, current methods are mostly designed to deal with long recordings of network dynamics, which (sometimes) may be infeasible. Thus, developing methods that rely only on short recordings will fill an important gap. Here we demonstrate that transient-responses of networks to dynamical perturbations reveal its structure. By applying external driving signals to units, we track how networks transiently respond to signals for short periods of time (˜10 measurements). We explicitly demonstrate the direct relation between these transient responses and network connectivity. As examples, we retrieve full connectivity of networks of coupled Kuramoto-like oscillators exhibiting complex non-periodic dynamics. Assuming sparseness, we safely recover network connectivity even if the number of different transient dynamics is much smaller than the number of units in the network. Our approach is model independent and does not rely on particular features of specific systems (e.g. fixed points or limit cycles).

DY 62.4 Thu 16:00 Poster A

Slow points and adiabatic fixed points in small neural networks — •Hendrik Wernecke and Claudius Gros — Institut für Theoretische Physik, Goethe-Universität, Max-von-Laue-Str. 1, Frankfurt am Main, Germany

Fixed points and limit cycles play an important role for the dynamics of neural networks. However, in the present work we examine the influence of slow points on the flow and motion in phase space.

A special kind of slow points, so-called attractor remnants, come into existence when adding a slowly varying dimension to a (faster) system. At the fixed points of the faster system the flow does no longer necessarily vanish, but these points are still present in the network as slow points. In order to examine the influence of the slow points on the compound system, the concept of adiabatic fixed points is introduced and the effect on small neural networks is discussed.

It turns out that with the help of these remnants one can describe a mechanism that spans limit cycles and determines the dynamical behaviour of the system. To analyze and compare systems of different dimensionality measures such as the system*s speed in phase space or the distance of the trajectory to the adiabatic fixed points are defined and their properties are examined.

DY 62.5 Thu 16:00 Poster A

Delay-Induced Dynamics of Localized Structures in Systems with Spatial Inhomogeneities — •Felix Tabbert and Svetlana Gurevich — Institut für Theoretische Physik, Münster

We are interested in the control of localized structures in spatially extended dissipative systems by time-delayed feedback. We show that changes in the delay time and the delay strength lead to various dynamical solutions including the formation of traveling waves, the annihilation of the localized solutions as well as drifting localized structures. We provide a linear stability analysis of the delayed system and obtain an analytical expression for the delay-induced instability threshold. Numerical simulations are also carried out, showing good agreement with the predicted instability-thresholds.

We also consider the effects of spatial inhomogeneities and defects, which are inevitable in any experimental setup. These inhomogeneities break symmetries of the system under consideration and therefore affect the critical modes of a localized solution. The competing effects of destabilizing delay and stabilizing defects are studied both numerically and in terms of a linear stability analysis.

DY 62.6 Thu 16:00 Poster A

Bifurcations in a minimal model of predator-swarm interactions — •Lukas Ophaus and Uwe Thiele — Institut für Theoretische Physik, Westfälische Wilhelms-Universtität Münster, Germany

We analyse a minimal model of predator-swarm interactions, that was first introduced by Y. Chen and T. Kolokolnikov. It was found that depending on the employed parameters and model details different dynamics occur. The complex shapes of the swarm are similar to observations in nature [1].

Here, we investigate in particular the bifurcations between static and dynamical states. We focus on the predator strength. Different outcomes are e.g. a stable ring of the prey with the predator at its centre, perdiodic chasing dynamics and solutions with irregular dynamics.

[1] Chen Y., Kolokolnikov T., J. R. Soc. Interface 11: 20131208 (2014).

DY 62.7 Thu 16:00 Poster A

Sound absorption of granular materials — •Tamara Zühlsdorff[1], Anna-Maria Daxlberger[1], and Thomas Grillenbeck[1,2] — [1]Ignaz-Günther-Gymnasium Rosenheim — [2]Fakultät für angewandte Natur- und Geisteswissenschaften, Fachhochschule Rosenheim

We examine the sound absorption coefficent of granules. We are es-

pecially interested in how the sound absorption depends on the state and the history of the material. Our experiment is implimented with variant of "Kundt's pipe" which sents an acoustic noise to granules and appraises the results. With these data we can calculate the sound absorption coefficient.

DY 62.8 Thu 16:00 Poster A

A Computer Simulation and Experiments to explain the phenomenon of convection rolls in rotating boxes — •Ann-Kathrin Raab[1,2], Adrian Ebert[2], and Thomas Grillenbeck[2] — [1]Technische Universität München D-85748, Germany — [2]Ignaz-Günther-Gymnasium Rosenheim D-83026, Germany

In an investigation of self-organized pattern formation in rotating packings, several experiments showed a phenomenon which no one can explain yet: In 2D packings sometimes there are convection rolls and sometimes not, whereas in 3D packings the patterns appear every time. A computer simulation should help to find out, whether the pattern building in 2D packings appears spontaneously or if there are any undiscovered circumstances which might lead to convection rolls. By using simple experiments with self constructed packings we will determine possible connections between the 2D simulation and the previous 2D and 3D experiments.

DY 62.9 Thu 16:00 Poster A

Controlling electrical charges in granular matter — •André Schella, Matthias Schröter, and Stephan Herminghaus — Max-Planck Institut für Dynamik und Selbstorganisation (MPIDS), Am Faßberg 17, 37077 Göttingen

It is known since ancient times that two bodies rubbed together acquire electrostatic charges. Even though such charges can have a tremendous impact on e. g. industrial powder manufacturing and dust storms, the physical basis behind this process called contact electrification is still on open debate [1], [2]. Recently, Liao et al. [3] examined the influence of the shaking conditions on the electrostatic charge of identical beads in a container. There, it was argued that contact electrification is mainly due to a contact potential difference between the beads and the container walls, whereas other authors found electrification even in same materials [4]. In this contribution, we present charge measurements of identical beads that were vertically shaken in a container. We will work out if material properties of the beads resp. the container, the shaking conditions and the environmental conditions affect the charge gained via contact electrification. [1] L. McCarty and G. Whitesides; Angew. Chem. Int. Ed. 47 (2008) 2188 [2] D. Lacks and R. Sankaran; J. Phys. D: Appl. Phys. 44 (2011) 453001 [3] Liao et al.; Powder Technology 208 (2011) 1-6 [4] S. Waitukaitis et al.; Phys. Rev. Letters 112 (2014) 218001

DY 62.10 Thu 16:00 Poster A

Simulation of the Chain Fountain — •Lukas Zwirner, Volker Becker, and Klaus Kassner — Otto-von-Guericke Universität Magdeburg, Institut für Theoretische Physik/Computerorientierte Theoretische Physik

Although chain dynamics is a subject of investigation since the 17th century, chains exhibit various counterintuitive behaviors, e. g. the end of a chain falls faster than g, due to tension (Hamm, Geminard: Am. J. Phys., Vol 78, No. 8. Aug. 2010).

Another spectacular example — the chain fountain — was investigated by Biggins et al. (Proc. R. Soc. A 470, 2014) inspired by a famous youtube video, which was made by Steve Mould and scored $\sim$ 1.5 million views. Such a chain fountain can be established by pulling an appropriate chain, resting in a beaker, over the rim. Then, it 'flows' out due to gravity. However, instead of just sliding on the rim the chain forms a fountain. Biggins et al. argued that the origin of the chain fountain should be a pushing reaction force from the beaker during pickup process.

Our aim is to simulate these phenomena. Therefore a two-dimensional DEM simulation for granular matter was altered to allow links between polygonal particles, represented by damped springs. This allows us to study the behavior of different 2D chains with little restrictions (the chain elements need to be convex polygons) and to get detailed insight into the forces and tensions acting in the chain and thus into the origin of the fountain formation.

DY 62.11 Thu 16:00 Poster A

Feuchtetransport in granularen Medien — •Yannick Weis[1] und Thomas Grillenbeck[2] — [1]Ignaz-Günther-Gymnasium, Rosenheim — [2]Fakulät für angewandte Natur- und Geisteswissenschaften, Fachhochschule Rosenheim

Herrscht ein Konzentrationsunterschied, so wandern Teilchen auch bei ruhiger Umgebung vom Ort höherer Konzentration zum Ort niedrigerer Konzentration. Liegt dieser Unterschied im Dampfdruckgehalt vor, so wandert Feuchte vom Ort höheren Drucks zum Ort niedrigeren Drucks. Dies kann auch durch eine Trennwand geschehen (Feuchtediffusion).

Wir untersuchen experimentell den Feuchtetransport durch granulare Packungen. Proben, welche ein Glas, gefüllt mit Trockenmittel (dry-cup) oder Wasser (wet-cup), abdichten (Holz im Vergleich zu Porenbeton), werden in den Klimaschrank bei 20 Grad Celsius und 50 % relativer Luftfeuchte gestellt. Die Proben bilden die Trennwand zwischen zwei Klimata mit unterschiedlich konstantem Dampfdruck bei konstanter Temperatur. Durch das Dampfdruckgefälle diffundiert Wasserdampf durch die Probe in den trockeneren Raum und erhöht dort die Wassermasse. Im feuchteren Raum wird die Wassermasse geringer. Diese Veränderung der Masse kann durch Wägung bestimmt werden.

DY 62.12 Thu 16:00 Poster A

Mechanical properties of sheared wet granular piles — •Anna-Lena Hippler[1], Marc Schaber[1], Somnath Karmakar[1], Mario Scheel[3], Marco DiMichiel[3], Martin Brinkmann[2], and Ralf Seemann[1,2] — [1]Experimental Physics, Saarland University, 66041 Saarbruecken, Germany — [2]MPI for Dynamics and Self-Organization, Am Faßberg 17, 37077 Goettingen, Germany — [3]European Synchrotron Radiation Facility, 6 rue Jules Horowitz, 38000 Grenoble, France

The mechanical properties of dry and wet bead packs are explored when being sheared with a parabolic profile at constant shear volume. The dissipated energy can be determined from the measured differential pressure and increases about linearly with external pressure for both dry and wet bead packs. However, the dissipated energy for wet beads has a finite value for vanishing external pressure and increases slower with external pressure compared to dry beads.

Using a downsized version of the shear cell the reorganization of beads and liquid is imaged using ultrafast x-ray micro-tomography. The movement of each bead can be tracked during the shear process. The relative movement of the beads causes the breakup of liquid capillary bridges and the liquid that was stored in the liquid bridges is redistributing within the bead pack. The contribution of the breaking capillary bridges to the dissipated energy can be quantified by directly detecting individual rupture events and by analyzing the bead-to-bead-distances.

DY 62.13 Thu 16:00 Poster A

Mesoscale Modelling of Aeolian Sand Transport — •Anne Meiwald, Marc Lämmel, and Klaus Kroy — Institute of Theoretical Physics, Leipzig, Germany

When driven by wind, sand in the desert or at the beach generates an impressive zoo of structures ranging from delicate ripples to wavy sand seas spanning orders of magnitude in their size. To understand how these structures emerge, it is essential to thoroughly describe of the underlying, seemingly chaotic, hopping motion of the sand grains. In order to make the complex grain scale physics more amenable to analytical studies, a coarse-graining approach was proposed that maps the ensemble of grain trajectories onto two populations representing fast salting and slow reptating grains [1,2]. On this basis, we now analyse the mesoscale structure of aeolian sand transport. We find the predicted mesoscopic observables like the mean hop length or height and particle velocity to be in a remarkable agreement with experimental data gained from various field and wind tunnel experiments. Since the physics on the mesoscopic scale is apparently insensitive to a higher resolution of the grains movement, we argue that our coarse-grained model offers a suitable starting point for the efficient numerical mesoscale modelling of aeolian sand transport and structure formation.

[1] Andreotti, B., J. Fluid Mech. 510, 47-70 (2004)
[2] Lämmel, M., Rings, D., Kroy, K., NJP 14, 093037 (2012)

DY 62.14 Thu 16:00 Poster A

Clustering and melting of a driven wet granular monolayer — Philipp Ramming, Ingo Rehberg, and •Kai Huang — Experimentalphysik V, Universität Bayreuth, D-95440 Bayreuth, Germany

Due to the cohesion arising from the capillary interactions, partially wet granular matter exhibits dramatically different mechanical properties in comparison to its dry counterpart. Focusing on agitated wet spherical particles in a quasi-two-dimensional configuration, we investi-

gate experimentally how the cohesion influences the collective behavior of wet granular matter and discuss possible links to the mobility of individual particles. As the agitation strength increases, a clustering into a wet granular crystal followed by a gradual melting arises. We characterize both transitions with the bond orientational order parameters and the mean kinetic energy of the particles through particle tracking. Moreover, the influence from the liquid content and the filling fraction will also be presented.

DY 62.15 Thu 16:00 Poster A

Thermal conductivity and geometric cohesion in aspherical granular materials — •Katharina Staudt[1], Felix Triska[1], and Thomas Grillenbeck[1,2] — [1]Ignaz-Günther-Gymnasium Rosenheim — [2]Fachhochschule Rosenheim

It is well known that the thermal conductivity of a granular material depends on the volume of granules per unit volume (packing fraction): The more intense the packing of thermo-conductive granules in a less conductive medium, the higher the thermal conductivity of the composite material. Most experiments and theoretical considerations use spherical granules; much less is known about the thermal conductivity of aspherical granular materials. Here, we use standard U-shaped staples as radically aspherical granules. Due to their peculiarity to show geometric cohesion (i.e., cohesion due to particle geometry), we hypothesize that their thermal conductivity at low packing fractions is higher than for comparable spherical granular materials.

In our experiments, we will systematically vary the packing fraction of the staples (in air) by different perturbations (like vibrating) or different manual stacking procedures and determine the thermal conductivity afterwards.

DY 62.16 Thu 16:00 Poster A

Contact angle hysteresis of a capillary bridge - control with inkjet printing — •Simeon Völkel, Ingo Rehberg, and Kai Huang — Experimentalphysik V, Universität Bayreuth, 95440 Bayreuth, Germany

When walking on the beach, one can notice a stripe of particularly firm ground splitting the dry sand and the sea. The stiffness of partially wet granular matter, particularly in the so called pendular regime, arises from the cohesion conveyed by the capillary bridges between adjacent granular particles. Existing models describing such a cohesive force typically include a constant contact angle between the wetting liquid and the particle as a parameter. In practicical situations, e.g. wet sand at the beach, an equilibrium contact angle should not be taken as granted due to environmental changes such as raining or draining.

In order to address experimentally such an influence, we control the volume of a single capillary bridge between two spherical particles with nanoliter resolution using an ink jet printer and employ evaporation for volume withdrawal. Using this technique we can drive our system into a limit cycle, which in turn allows precise measurement of the contact angle hysteresis via image analysis.

DY 62.17 Thu 16:00 Poster A

3D contact force measurement in a granular packing — •Junaid Masud Laskar[1], Stephan Herminghaus[1], Matthias Schröter[1], and Karen E. Daniels[2] — [1]Dynamics of Complex Fluids, Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany — [2]Department of Physics, North Carolina State University, Raleigh, USA

Knowing the contact forces and their statistical distributions inside a granular packing is a central question in granular physics. Measurement of contact force distributions and force chains till now have been possible only in 2D [1,2]. However, the physics is expected to be different inside 3D granular packings.

Towards this end, we have implemented a two photon spectroscopy technique, by harnessing the pressure dependent fluorescence property of ruby [3]. The technical challenges, introduced by the high refractive index (RI ~ 1.76) of ruby, are solved by designing a high numerical aperture (NA~1.4) objective lens and finding a RI matched light scattering free immersion liquid solution. The first proof of concept experimental results will be discussed.

References: [1] T. S. Majumdar and R. P. Behringer, Nature 453, 1079 (2005) [2] Karen E. Daniels and Nicholas W. Hayman, J. of Geophys. Res. 113, B11411 (2008) [3] Y. Chen et al., J. Appl. Phys. 101, 084908 (2007)

DY 62.18 Thu 16:00 Poster A

Friction with your neighbors? Think locally! — •Matthias Schröter[1], Max Neudecker[1], Cyprian Lewandowski[2], Pascal Wieland[2], Claus Heussinger[2], Fabian Schaller[3], and Gerd Schröder-Turk[3] — [1]Max Planck Institute for Dynamics and Self-Organization, Göttingen — [2]Georg-August University of Göttingen — [3]Friedrich-Alexander-Universität Erlangen-Nürnberg

Understanding how the number of contacts Z in a packing of particles depends on the global volume fraction ϕ is a fundamental questions in soft matter physics. If the particles under consideration are soft and frictionless spheres, such as emulsions and foams, assuming $Z(\phi)$ is reasonable because additional contacts are formed by the globally isotropic compression of the particles which also increases ϕ. However, in frictional granular media the control of ϕ is not achieved by compression but by changing the geometric structure of the sample; if we want to fill more grains into a container we do not compress them with a piston, but we tap the container a couple of times on the table.

But if Z and ϕ are not simultaneously controlled by a globally defined parameter such as pressure, the idea of a function $Z(\phi)$ runs into an epistemological problem. Contacts are now formed at the scale of individual particles and their neighbors, a scale where ϕ is undefined. What is therefore needed for the theoretical description of frictional particles is an ansatz which explains Z using only locally defined parameters. This poster reviews recent progress towards such a theory based on experimental results obtained by X-ray tomography of packings of spheres, ellipsoids, cylinders and tetrahedra.

DY 62.19 Thu 16:00 Poster A

Coarse-grained Simulations of Dune Field Evolution — •Meike Will, Sven Auschra, Marc Lämmel, and Klaus Kroy — Institut für Theoretische Physik, Universität Leipzig, Germany

Crescent-shaped sand dunes, so-called barchans, are among the most impressive structures observed in arid regions on Earth and on Mars. Well established dune models [1] suggest that isolated barchans are unstable when fed by constant sand flux – they either shrink until they vanish or grow forever. As barchans commonly arrange in large and homogeneous fields, the existence of these assemblies indicates that interactions among adjacent dunes can stabilise them [2].

To investigate the underlying mechanism, we start from an approximate analytical parametrization of the shape and mass evolution of individual barchans [3] and develop a coarse-grained model that explicitly accounts for the wind-driven mass exchange between consecutive dunes. Sand supplied by the horns of upwind followers to a barchan initiates a complex response of its shape and mass. A numerical implementation of the derived model relations is used to simulate large barchan fields. Preliminary results indicate that the dune field, as it advances downwind, converges towards a steady state that is characterized by a fixed point that closely controls dune size and density, thereby reproducing field obsevations.

[1] Kroy, K. et al., Phys. Rev. Lett. 88, 054301 (2002)
[2] Durán, O. et al., Nonlin. Processes Geophys. 18, 455-467 (2011)
[3] Fischer, S. et al., Phys. Rev. E 77, 031302 (2008)

DY 62.20 Thu 16:00 Poster A

Traveling waves: orientational and reflection effects induced by sudden control parameter changes — •Fabian Bergmann and Walter Zimmermann — Theoretische Physik, Universität Bayreuth, Bayreuth

Traveling wave (TW) patterns are observed in many nonequilibrium systems, including chemical reactions [1, 2] or biological systems. In light-sensitive chemical reaction-diffusion systems or in certain biological systems [3] the respective control parameter can be suddenly changed from beyond to below critical.

We reveal some generic phenomena induced by such control parameter steps in one and two dimensions. In 2d we find an orientational effect of the step on TWs, where the waves orientate with their propagation direction perpendicular to the step. This behavior has also been found in a recent experiment.

If we restrict our system to one spatial dimension, a sudden control parameter drop from beyond to below threshold has consequences similar to suppressing boundary conditions [4]. Depending on the length scale of the control parameter change or on the group velocity of the TWs we can switch between TWs in the supercritical range to so-called blinking states, where the envelope of TWs changes as a function of time.

[1] M. Dolnik, A. R. Rovinsky, A. M. Zhabotinsky, I. R. Epstein, J. Phys. Chem. A 103, 38 (1999) [2] V. Vanag and I. R. Epstein, Phys. Rev. Lett. 87, 228301 (2001) [3] J. Schweizer, M. Loose, M. Bonny, K. Kruse, I. Münch, P. Schwille, PNAS 109, 15382 (2012) [4] M. C.

Cross, Phys. Rev. A 38, 3593 (1988)

DY 62.21 Thu 16:00 Poster A

Influence of spatio-temporal modulations on the orientation of stripe patterns — •Lisa Rapp, Vanessa Weith, Alexei Krekhov, and Walter Zimmermann — Theoretische Physik, Universität Bayreuth, Bayreuth

Labyrinth-like stripe patterns occur in a variety of isotropic systems from chemical reactions, thermal convection and vegetation patterns to diblock copolymers. For a deeper understanding of the dynamics of patterns as well as for many technical applications, however, the control of the stripe patterns is important. We show that spatiotemporal modulations are an effective mechanism to control the pattern morphology. Using traveling, large modulation wavelengths compared to the intrinsic periodicity of the pattern, labyrinth-like patterns can be straightened in favor of regular stripe patterns. The orientation of the stripes can be controlled and selected by varying the velocity of the traveling modulation. In systems with broken symmetries long-wavelength modulations can be used to suppress other patterns such as hexagons or squares in favor of stripe patterns. To support the results obtained from linear stability analysis, we quantitatively analyze simulations of the two-dimensional Swift-Hohenberg model with regard to the distributions of local orientation angles of the stripes.

DY 62.22 Thu 16:00 Poster A

Non-Equilibrium Heating Dynamics of Interacting Luttinger Liquids — •Sebastian Huber[1,2], Michael Buchhold[1,2], and Sebastian Diehl[1,2] — [1]Institute of Theoretical Physics, Technische Universität Dresden, 01069 Dresden, Germany — [2]Institute of Theoretical Physics, University of Innsbruck, A-6020 Innsbruck, Austria

Thermalization dynamics of one dimensional bosonic systems have recently attracted strong attention. As a generic example of a non-integrable model, we investigate the dynamics of an interacting Luttinger Liquid driven out of equilibrium by persistent heating. In order to find signatures of thermalization and determine the non-equilibrium dynamics of this system, we derive the kinetic equation for the time dependent phonon density and self-energy in a Keldysh non-equilibrium framework.

The resulting dynamics of the time dependent phonon density can be separated into two distinct momentum regimes. For large momenta, an effective thermalization process sets in, spreading continously to lower momenta. In contrast, at low momenta, the system is described by a non-equilibrium distribution, growing linear in the momentum variable. This linear increase is protected by the structure of the three-phonon scattering vertex.

In the non-equilibrium regime, the scaling form of the phonon lifetimes is modified compared to the known equilibrium result, resulting in a new universal exponent. We show that both the structure of the phonon density and the scaling of the phonon lifetimes can be experimentally detected by means of Bragg spectroscopy.

DY 62.23 Thu 16:00 Poster A

Synchronization and Phase Separation of Motile Oscillators — •Sebastian Milster and Lutz Schimansky-Geier — Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr.15, 12489 Berlin

We present a model of noisy interacting Kuramoto phase oscillators with unimodal and bimodal frequency distributions. The oscillators have also the ability to move in two spatial dimensions as noisy self-propelled particles. Within a small sensing radius, these moving oscillators are locally coupled. The motility facilitates a rearrangement of the oscillators. It changes locally the network structure while maintaining the global degree distribution.

This complex temporal network of non-identical phase oscillators exhibits various behaviors ranging from completely disordered over transient waves to globally synchronized states. In this work we study the influence of the motility on the synchronization processes in vessels and periodic confinements. We conclude to what extend the techniques of static network analyzes are applicable. First insights into the underlying dynamics are deduced from a globally coupled network approach and we present analytical results for static networks with a multimodal distribution of the intrinsic frequencies. For identical oscillators, we estimate critical values of coupling strength for the onset of synchronization. In case of a bimodal frequency distribution, a manipulation of the oscillators' motility in the dependence of the degree of synchronization leads to a spatial separation of the two populations with different frequencies.

DY 62.24 Thu 16:00 Poster A

Anisotropic Finite Size Scaling of Orientation Correlation Functions in Stripe Phases Free of Topological Defects — •Christian Riesch, Günter Radons, and Robert Magerle — Institut für Physik, Technische Universität Chemnitz, D-09107 Chemnitz

Recently, we discovered aging in the orientation dynamics of an ordered stripe-forming system in two dimensions, referred to as model B with Coulomb interactions [1]. Here, we study the influence of the aspect ratio and the size of the system on this dynamics. We find that the underlying mechanism governing the non-equilibrium evolution is the anisotropic coarsening of correlated regions within the orientation field. The spatial correlation functions perpendicular and parallel to the stripes coarsen as power laws of time with different exponents. The observed type of aging is also found in stripe phases described by the conserved and nonconserved Swift-Hohenberg model.

[1] C. Riesch, G. Radons, and R. Magerle, *Aging of orientation fluctuations in stripe phases*, Phys. Rev. E **90**, 052101 (2014).