DY 27: Poster II

Time: Thursday 16:00–18:00 Location: P1B

DY 27.1 Thu 16:00 P1B

Effective degrees of freedom and hyperbolicity of infinite dimensional systems — •Hongliu Yang and Guenter Radons — Institute of Physics, Chemnitz University of Technology, D-09107 Chemnitz, Germany

Our numerical studies on hyperbolicity of the one dimensional Kuramoto-Sivashinsky equation reveals a natural splitting of its tangent space, an indecomposable manifold spanned by a set of relatively unstable directions and its complement spanned by the remaining purely decaying directions. The strong hyperbolicity of this splitting indicates that dynamics on this indecomposable manifold of active nontrivial degrees of freedom is uniformly separated from the trivial dynamics of being attracted to that manifold for the remaining degrees of freedom. Moreover, the dimension of the isolated manifold shows a stepwise increase with system size, which indicates the existence of a new characteristic length scale for extensive chaos of infinite dimensional systems.

[1] H.L. Yang, K.A. Takeuchi, F. Ginelli, H. Chaté and G. Radons, "Hyperbolicity and the effective dimension of spatially-extended dissipative systems" *arXiv:0807.5073.v2.*

DY 27.2 Thu 16:00 P1B

Hamiltonian dynamics with a disordered one-dimensional kick-potential — •Ines Hartwig and Günter Radons — Technische Universität Chemnitz, Chemnitz, Germany

We substitute the cosine-potential of the well-known Chirikov-Taylor standard map with a one-dimensional analytic potential with disorder. The potential is made periodic, thus introducing a fundamental cell in phase space. Island structures in typical Poincaré surfaces of section are shown to differ from the standard map. Statistics of transport characteristics computed numerically include : fractions of particles escaping the fundamental cell, distributions of critical perturbation amplitudes for the breaking of the last KAM-tori and transport exponents in both the momentum and the coordinate direction. Transport is shown to increase with increasing period of the potential, depending on the distribution of the potential.

DY 27.3 Thu 16:00 P1B

Lyapunov spectrum of linear Delay Differential Equation with time-varying delay — •Andreas Otto and Günter Radons — Institute of Physics, Chemnitz University of Technology, D-09107 Chemnitz, Germany

Many dynamical systems for instance in engineering science, biology, chemistry, economics and physics are described by Delay Differential Equations (DDE). Hence, there is an essential interest, what happens if delay time changes in time. In this case special phenomena occur in the dynamics of the system.

Our studies on the Lyapunov spectrum of simple linear, scalar, autonomous DDE with periodically time-varying delay try to uncover these special behavior. In spite of inaccuracy in the discrete approximation of the system smaller exponents and their associated Lyapunov vectors contain important information on the dynamics.

Possible extremely small exponents indicate fluctuations of phase space dimension during integration. Furthermore, exponents equal negative infinity stand for a reduced phase space, so that parts of initial function don't affect solutions of the system. Apart from effect of time-varying delay to the dimension, also different regions of initial function may have differing influence on the solution in contrast to DDE with constant delay.

DY 27.4 Thu 16:00 P1B

Synchronization of chaotic units with time delayed bi-directional couplings — Anja Englert, •Sven Heiligenthal, and Wolfgang Kinzel — Institut für Theoretische Physik und Astrophysik, Universitität Würzburg, Germany

The synchronization of chaotic units with bi-directional coupling may have applications for public channel cryptography [1]. However, two chaotic units can only synchronize if a self-feedback is added which is carefully adjusted to the transmission time delay. We investigate two methods to overcome this severe restriction:

1. Multiple feedback delay times [2] and
2. three mutually coupled chaotic units.

Numerical and analytical model calculations show the parameter space for which complete synchronization is achievable.

References:

[1] Ido Kanter, Noam Gross, Einat Klein, Evi Kopelowitz, Pinhas Yoskovits, Lev Khaykovich, Wolfgang Kinzel, and Michael Rosenbluh. Synchronization of mutually coupled chaotic lasers in the presence of a shutter. Phys. Rev. Lett., 98(15):154101, 2007.

[2] M Zigzag, M Butkovski, A. Englert, W. Kinzel, and I. Kanter. Emergence of zero-lag synchronization in generic mutually coupled chaotic systems. to be published, see http://arxiv.org/abs/0811.4066.

See: www.physik.uni-wuerzburg.de/?id=2200

DY 27.5 Thu 16:00 P1B

Entropy calculation of Markov processes with varying order via Blackwell's measure — •Michael Bauer and Günter Radons — Chemnitz University of Technology, 09107 Chemnitz, Germany

Our objective is to calculate the entropy of discrete-time Markov processes with fluctuating order in a finite state space. Such processes may arise e.g. in the symbolic dynamics of dynamical systems with varying memory length. Due to the change of order, transition matrices with different ranks are applied to the initial state resulting in a random matrix product. For a sequence of symbols produced by such a time-variant Markov chain the Kolmogorov-Sinai entropy is calculated using Blackwell's measure [1]. Therefore, special cases of this non-stationary process such as purely random variation and periodic variation are investigated and can be calculated analytically. A comparison to previous results [2] is drawn. We also provide results for processes with Markovian variation of memory establishing a fractal distribution in Blackwell's measure.

[1] D. Blackwell, The entropy of functions of finite-state Markov chains, Transactions of the First Prague Conference on Information Theory, Statistical Decision Functions, and Random Processes, pages 13–20, 1957.

[2] M. Bauer, Dynamical characterization of Markov processes with varying order, Master Thesis, Chemnitz University of Technology, 2008.

DY 27.6 Thu 16:00 P1B

Dynamics of Hysteretic Systems with Preisach-Nonlinearity — •Andreas Zienert and Günter Radons — Chemnitz University of Technology, D-09107 Chemnitz

Hysteresis plays an important role in science and engineering. In most applications dynamical systems are coupled with hysteretic subsystems. This leads to differential equations with hysteresis operators. We investigate the model of an iron pendulum within an external magnetic field. The dynamics of the pendulum can be described with a second order ordinary differential equation. The interaction with the magnetic field is modeled by a Preisach-operator, because the Preisach-model has proven to be an application independent tool for describing hysteretic systems.

The focus of our research is on whether such a hysteretic iron pendulum shows regular or chaotic dynamics. The main problem is that the phase space is infinite-dimensional due to the memory of the Preisach-operator. We calculate power spectra, apply the 0-1-Test for chaos and estimate the largest Lyapunov exponent for some phase space projection. For the latter we also provide a method considering the full memory stored by the Preisach-operator.

DY 27.7 Thu 16:00 P1B

Local Low Dimensionality and Predictability in the Lorenz96 Model of Atmospheric Dynamics — •Stefan Siegert and Günter Radons — Chemnitz University of Technology, Chemnitz, Germany

The Lorenz96 model is a prototype model mimicking certain features of mid-latitude atmospheric dynamics. It is widely used for conceptual studies of atmospheric predictability. Bred vectors characterize finite-time dynamics of high-dimensional chaotic systems under the influence of finite-size perturbations. In the present study, Bred vectors of the Lorenz96 model are characterized in terms of localization, convergence and propagation and compared to their infinitesimal-size, infinite-time counterpart, the leading Lyapunov vectors.

In recent studies it was found, that Bred vectors in atmospheric models exhibit anomalously low dimensionality in localized regions. This finding might have important implications for predictability. In the present study, regions of low Bred vector dimensionality in the Lorenz96 model were identified. There is evidence, that short-term predictability, defined in terms of information entropy of an ensemble of solutions, is low (i. e. entropy is high) in regions of low Bred vector dimension. Presently, further connections between local low dimensionality and predictability are established.

DY 27.8 Thu 16:00 P1B

Oscillatory Zoning in binary solid solution: a non-linear analysis — Tanja Mues and •Andreas Heuer — Institut für physikalische Chemie, Universität Münster, 48149 Münster

Oscillatory Zoning (OZ) is a phenomenon common to many geologically formed crystals. A model of OZ in a binary solid solution grown from an aqueous solution can be described by a two dimensional system of nonlinear partial differential equations, which were analyzed via linear stability analysis in the past. These results were compared with a numerical simulation of the full non-linear system. The non-linear terms give rise to new features in the structure formation by suppressing non-homogeneous modes. With a numerical and analytical Fourier analysis in the nonlinear regime we want to understand this behavior.

DY 27.9 Thu 16:00 P1B

Hydrodynamic Lyapunov modes in binary 1D-Lennard-Jones fluids — •Christian Drobniewski and Günter Radons — TU-Chemnitz 09107

Corresponding to the partial structure factors of molecular hydrodynamics we defined static and dynamic correlation functions of the Lyapunov vectors ([1],[2]). By this it was made possible to identify Lyapunov modes in chaotic many particle systems with softcore interactions (Lennard-Jones fluids). Lennard-Jones fluids are a well know and widely treated class of systems which are especially investigated in view of it's relevance for the glass transition. With these correlation functions we open a new batch of investigation possibilities. We present results for a binary 1D-Lennard-Jones fluid with alternating masses. Special focus lies on the scaling behaviour of the distinct properties in dependence of the system parameters. In addition we compare the results with the results for simpler model systems such as the linear chain or coupled map lattices with alternating masses ([3]). To recognize differences in the behaviour of the particle sorts we splitted the above correlations functions for each of them.

[1] Hong-liu Yang and G. Radons, Hydrodynamic Lyapunov modes in coupled map lattices, Phys. Rev. E 73, 016202 (2006),

[2] G. Radons and H. L. Yang, Static and Dynamic Correlations in Many-Particle Lyapunov Vectors, arXiv nlin. CD/0404028

[3] H.L. Yang, G. Radons, Lyapunov Spectral Gap and Branch Splitting of Lyapunov Modes in a Diatomic System, Phys. Rev. Lett. 99, 164101 (2007)

DY 27.10 Thu 16:00 P1B

Complex behavior of dimensional collapse of iterated maps with fluctuating delay times — •Jian Wang, Hong-liu Yang, and Günter Radons — Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany

Delay systems used to model retarded actions are relevant in many fields such as optics, mechanical machining, biology or physiology. A frequently encountered situation is that the length of the delay time changes with time. Due to the fluctuation of the delay time the dimension of the system dynamics collapses. This implies infinite contraction rates thereby leading to diverging Lyapunov exponents. In this study we use iterated map systems to investigate the influence of fluctuating delay times on the system dynamics. For simplicity, the delay time in our system can change only between two values t_1 and t_2. Two cases, periodic or random variation of the delay, were studied. The characteristic feature of the dimensional collapse including the Lyapunov spectrum, number of finite Lyapunov exponents, Kolmogorov-Sinai entropy, and Kaplan-Yorke dimension are investigated.

DY 27.11 Thu 16:00 P1B

Effect of curvature on the low-frequency fidelity of an active cochlea model — •Verena Sterr and Andreas Engel — Carl von Ossietzky Universität Oldenburg, 26111 Oldenburg

The mammalian cochlea has been studied extensively from various points of view, giving rise to a lot of different models each of which emphasizes certain aspects while neglecting others. However, the fact that the cochleae of most mammals is spiral-shaped has been ignored most of the time, the common interpretation being that coiling merely helps to put the cochlea into limited space.

Only recently has it been discovered, that the coiling causes a redistribution of the wave energy towards the outer wall, thereby enhancing radial shearing of the Basilar membrane in the low-frequency region [1, 2]. This theoretical outcome has been supported by the experimental observation that the hearing thresholds of many mammals can be related systematically to the product of Basilar membrane length and number of spiral turns [2].

Until now, this interesting phenomenon has been examined within the framework of passive linear cochlea models only. In our present work, we focus on the influence of curvature on the active nonlinear model which has been proposed by T. Duke and F. Jülicher [3].

[1] D. Manoussaki, E. K. Dimitriadis, and R. S. Chadwick, Phys. Rev. Lett. 96, 088701 (2006)

[2] D. Manoussaki et al., Proc. Nat. Acad. Sci. 105(16), 6162 (2008)

[3] T. Duke, F. Juelicher, Phys. Rev. Lett. 90(15), 158101 (2003)

DY 27.12 Thu 16:00 P1B

Cluster and splay states in networks of delay-coupled Stuart-Landau oscillators — •Chol-Ung Choe, Thomas Dahms, Philipp Hövel, and Eckehard Schöll — Institut f. Theo. Physik, Sekr. EW 7-1, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin, Germany

We study one-dimensional ring and chain configurations of delay-coupled Stuart-Landau oscillators. The single elements are given by the complex normal form of supercritical Hopf bifurcation. Using the master stability function approach, we calculate the Floquet exponents of the synchronized state. Our simulations yield splay states or cluster dynamics, depending upon the chosen coupling delay.

DY 27.13 Thu 16:00 P1B

Dynamical trapping and chaotic scattering of the harmonically driven barrier — •Florian Koch[1], Florian Lenz[1], Christoph Petri[1], Fotis Diakonos[3], and Peter Schmelcher[1,2] — [1]Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg, Germany — [2]Theoretische Chemie, Institut für Physikalische Chemie, Universität Heidelberg, INF 229, 69120 Heidelberg, Germany — [3]Department of Physics, University of Athens, GR-15771 Athens, Greece

We provide a detailed analysis of the classical nonlinear dynamics of a single driven square potential barrier with harmonically oscillating position. The system exhibits dynamical trapping which is associated with the existence of a stable island in phase space. Due to the unstable periodic orbits of the KAM structure, the driven barrier is a chaotic scatterer and shows stickiness of scattering trajectories in the vicinity of the stable island. The transmission function of a suitably prepared ensemble yields results which are very similar to tunneling resonances in the quantum mechanical regime.

DY 27.14 Thu 16:00 P1B

Occurrence of normal and anomalous diffusion in the time-dependent elliptical billiard — •Christoph Petri[1], Florian Lenz[1], Florian Koch[1], Fotis Diakonos[3], and Peter Schmelcher[1,2] — [1]Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg, Germany — [2]Theoretische Chemie, Institut für Physikalische Chemie, Universität Heidelberg, INF 229, 69120 Heidelberg, Germany — [3]Department of Physics, University of Athens, GR-15771 Athens, Greece

We study the phase space topology of two dimensional driven billiards and its impact on diffusion processes. In this respect, the time-dependent ellipse is extraordinary, because it is so far the only known system, which exhibits Fermi acceleration, although the static counterpart is integrable. Depending on the driving mode we find either anomalous or normal diffusion in momentum space, which is due to the different structure of the underlying four dimensional phase space. For a certain class of modes there is actually a crossover from initially amplitude dependent sub- to asymptotically universal normal diffusion. Furthermore we can make the acceleration process saturate by introducing friction into the system.

DY 27.15 Thu 16:00 P1B

Complete synchronization of chaotic systems with time delayed coupling — •Thomas Jüngling[1], Hartmut Benner[1], Hiroyuki Shirahama[2], and Kazuhiro Fukushima[3] — [1]Institut für Festkörperphysik, TU Darmstadt, 64289 Darmstadt, Germany —

[2]Faculty of Education, Ehime University, Matsuyama 790-8577, Japan — [3]Faculty of Education, Kumamoto University, Kumamoto 860-8555, Japan

Complete chaotic synchronization of two mutually coupled systems is generally unstable if there is a time delay in the coupling terms larger than a critical value. For most systems this critical time delay is very small compared to their typical time scales. We present an example of two delay-coupled Rössler circuits which show stable complete synchronization for a delay time of about three periods of the mean chaotic cycle time. We have studied this phenomenon in both numerical simulations and electronic circuit experiments on variation of the coupling scheme and internal system parameters, and have investigated the effect on the critical delay time. Our results reveal general limits for stable complete synchronization depending on the internal Lyapunov exponent and the specific coupling coefficients.

DY 27.16 Thu 16:00 P1B

Time delay and noise in the Kuramoto model of coupled oscillators — •Lucas Wetzel[1], Saul Ares[1], Andrew C. Oates[2], and Frank Julicher[1] — [1]Max Planck Institute for the Physics of Complex Systems — [2]Max Planck Institute of Molecular Cell Biology and Genetics

Systems of coupled oscillators are important in several physical, chemical, engineering, and biological phenomena. Traditionally the coupling between different oscillators was assumed to be instantaneous, neglecting the time necessary for information flow between different oscillators. Time delays in the coupling affect fundamental properties of the system, like synchronization or the collective period of oscillators. However, little is known of the joint effect of noise and time delay. The noise can come from a distribution of the intrinsic frequencies of the oscillators, from a dynamical noise affecting the oscillators, or from stochastic variations of the time delays in the coupling. The latter case can be described by a distributed delay, where time delays are no longer given by a single number, but by a distribution over past times affecting the rate of oscillation in the present.

In this contribution we study the Kuramoto model of phase oscillators as a representative of systems of coupled oscillators. We introduce time delay in the coupling and characterize its effects in the presence of noise. Together with the basic understanding of the problem, we are motivated by the study of genetic oscillations in vertebrate segmentation, where a description based on phase oscillators has shown to be a valuable tool.

DY 27.17 Thu 16:00 P1B

Dynamical phase diagrams for spiral waves attached to obstacles and suppression of spiral waves by boundary effects — •Claudia Hamann, Mario Einax, and Philipp Maass — Institut für Physik, Technische Universität Ilmenau, Germany

Based on the FitzHugh-Nagumo equations we study the pinning of spiral waves by spatial inhomogeneities associated with variations of cell properties like excitability and resting state stability. These inhomogeneities can be a pacemaker source for atrial fibrillation. Dynamical phase diagrams are constructed that classify the spatio-temporal excitation patterns in dependence of the size of the obstacle and the strength of the changes of the cell properties. With increasing modification of the cell properties a transition from functional to anatomical reentry of spiral waves is found. We further show that boundaries in the neighborhood of the obstacle can suppress spiral wave generation. This allows us to gain insight into the principle and effectiveness of catheter ablation used in medical treatment of atrial fibrillation [1].

[1] C. Hamann, diploma thesis, Technische Universität Ilmenau, 2008

DY 27.18 Thu 16:00 P1B

Network communications: Applications to epileptic seizures — •Cornelia Petrovic and Rudolf Friedrich — Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str.9, D-48149 Münster, Deutschland

Epilepsy is one of the most common neurological diseases, one percent of the world's population suffering from it. It is characterized by the sudden onset of recurrent seizures due to a collective, "hypersynchronous" activity of extended populations of neurons. Since up to now only about two thirds of the patients respond to medication, understanding of the dynamic mechanisms which drive the epileptic seizures is of great interest. It appears to be that the understanding of seizure dynamics can be decisively improved by considering epileptic seizures as network phenomena.

DY 27.19 Thu 16:00 P1B

Data assimilation as a hamiltonian boundary value problem — •Jochen Bröcker — Max Planck Institute for the Physics of Complex Systems, Nöthnitzer Str. 34, 01187 Dresden, Germany

Time series are often assumed to arise as observations from an underlying dynamical system. To analyze or forecast such systems, it is necessary to compute trajectories which are on the one hand consistent with the model dynamics, but which on the other hand closely follow (or 'shadow') the recent history of observations. This process (referred to as data assimilation in the atmospheric sciences or smoothing in the engineering community) is revisited in this contribution.

An approach to data assimilation using concepts from nonlinear control theory will be presented. The dynamics are augmented by a control force, which is chosen so as to make the discrepancy between the trajectory and the actual observations, the tracking error, small. At the same time, large control actions are penalized as well, in order to create trajectories which are as consistent with the dynamics as possible.

Provided there is no model error, the control is expected to vanish once the dynamics is "on track". In the presence of model error though, a small but non-vanishing control will remain necessary to keep the trajectory close to the observations. It is demonstrated that this approach provides an effective means to regularize the problem and to control the trade–off between perfectly following the observations and perfectly obeying the dynamics. Furthermore, an ex–post analysis of the control forces should provide information on model imperfections.

DY 27.20 Thu 16:00 P1B

Structure of Bred Vectors in Spatiotemporal Chaos — •Sarah Hallerberg, Diego Pazó, Juan M. López, and Miguel A. Rodríguez — Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, E-39905, Spain

The spatiotemporal dynamics of characteristic Lyapunov vectors in spatially extended chaotic systems can be related to properties of scale invariant growing surfaces [1,2]. These results are based on a Hopf-Cole transformation, which reveals that the Lyapunov vectors corresponding to the largest Lyapunov exponents are "piecewise copies" of the first Lyapunov vector. We study now, whether similar scaling properties, can also be observed for bred vectors, which are used in the context of data assimilation for weather forecasting. Moreover, we propose a new method to estimate the spectrum of Lyapunov exponents corresponding to the most expanding directions using bred vectors. Both results are developed by investigating bred vectors in the model proposed by Lorenz in 1996 [4] and in a lattice of coupled logistic maps.

References: [1] D. Pazó, I. G. Szendro, J. M. López and M. A. Rodríguez, PRE 78, 016209, (2008); [2] I. G. Szendro, D. Pazó, M. A. Rodríguez and J. M. López,PRE 76, 025202(R) (2007); [3] E. Kalnay, M. Corazza and M. Cai, Pp. 173-177 in Proc. of AMS Symposium on Observations, Data Assimilation and Probabilistic Prediction, (2002); [4] E. N. Lorenz in Proc. of the Seminar on Predictability, Vol I., edited by T. Palmer, ECMWF, pp. 1-18 (1996)

DY 27.21 Thu 16:00 P1B

Detecting chaos and determining the dimensions of tori in Fermi-Pasta-Ulam lattices by the Generalized Alignment Index method — •Charalampos Skokos[1], Tassos Bountis[2], and Chris Antonopoulos[3] — [1]Max Planck Institute for the Physics of Complex Systems, Nothnitzer Str. 38, D-01187 Dresden, Germany — [2]Department of Mathematics, University of Patras, GR-26500, Patras, Greece — [3]Universite Libre de Bruxelles, Campus de la Plaine, CP 231, Boulevard du Triomphe, B-1050, Brussels, Belgium

The recently introduced Generalized Alignment Index (GALI) method of chaos detection (Skokos et al. Physica D, 2007, 231, 30) is applied to distinguish efficiently between regular and chaotic orbits of multi–dimensional Hamiltonian systems. The GALI of order k ($GALI_k$) is proportional to volume elements formed by k initially linearly independent unit deviation vectors whose magnitude is normalized to unity from time to time. For chaotic orbits, $GALI_k$ tends exponentially to zero with exponents that involve the values of several Lyapunov exponents, while in the case of regular orbits, $GALI_k$ fluctuates around nonzero values or goes to zero following particular power laws that depend on the dimension of the torus and on the order k. We apply these indices to rapidly detect chaotic oscillations, identify low–dimensional tori of Fermi-Pasta-Ulam (FPU) lattices and predict weak diffusion away from quasiperiodic motion, long before it is actually observed in the oscillations (Skokos et al. Eur. Phys. J. Special Topics, 2008, 165, 5). We also present an efficient computation scheme of the GALI's, based on the Singular Value Decomposition (SVD) algorithm.

DY 27.22 Thu 16:00 P1B

Renyi Entropies of Quasi-Periodically Forced Nonlinear Systems — •Annette Witt — Max-Planck-Institute for Dynamics and Self-organization, Göttingen, Germany

Strange non-chaotic attractors (SNAs) which are characterized by a fractal geometry, although the underlining dynamics is non-chaotic, are typical for quasi-periodically forced nonlinear systems. In order to characterize the complex dynamics of these systems, their Renyi entropies K(q) are studied. Computational results are presented for time-discrete and time-continuous dynamical systems. Two types of dynamics on SNAs are found: (a) Homogeneous dynamics that is characterized by K(q)=0 for all crwoding indices q. (b) Non-homogeneous dynamics where the corresponding Renyi entropies decrease with q. Here, Renyi entropies K(q)=0 for all crowding indexes q>1 demonstrate the nonchaotic character of the considered systems. Moreover, positive Renyi entropies, K(q)>0, for crowding indexes q<q* with q*<1 stand for a fraction of exponentially expanding initially nearby trajectories. It is shown that this critical crowding index q* quantifies the ratio between regularity and chaos.

DY 27.23 Thu 16:00 P1B

Scenarios for generalized synchronization with chaotic driving — Th. Umeshkanta Singh, •Amitabha Nandi, and Ram Ramaswamy — School of Physical Sciences, Jawaharlal Nehru University, New Delhi - 110067

In chaotically driven nonlinear dynamical systems, weak generalized synchrony can arise through distinct scenarios or routes in a manner similar to the onset of low-dimensional chaos or the creation of strange nonchaotic attractors in quasiperiodically driven systems. The limit sets of the dynamics for weak generalized synchronization are nonchaotic the Lyapunov exponent is nonpositive and are geometrically strange. Quantitative measures related to the parameter sensitivity exponent and finite-time Lyapunov exponent distributions can be defined in order to characterize generalized synchronization.

DY 27.24 Thu 16:00 P1B

Ising and Bloch fronts in parametrically forced oscillating lattices — •Ernesto M. Nicola[1] and Diego Pazo[2] — [1]Max Planck Institute for the Physics of Complex Systems, Dresden, Germany — [2]Instituto de Física de Cantabria, IFCA (CSIC-UC), Santander, Spain

We study the dynamics of fronts in lattices of coupled forced oscillators. Using as a prototypical example the discrete Ginzburg-Landau equation, we show that much information about front bifurcations can be extracted by projecting onto a cylindrical phase space. We show that the discretization induces the existence of new types of Ising and Bloch fronts. These fronts exhibit a highly non-trivial dynamic behavior. Starting from a normal form that describes the nonequilibrium Ising-Bloch bifurcation in the continuum [1] and using symmetry arguments, we derive a simple dynamical system that captures the dynamics of fronts in the lattice [2].

[1] Coullet *et al.*, Phys. Rev. Lett. **65**, 1352 (1990).
[2] Pazó and Nicola, Erophys. Lett. **81**, 10009 (2008).