DY 59: Posters - Nonlinear General

Time: Thursday 17:00–19:30 Location: P1A

DY 59.1 Thu 17:00 P1A

Tests for chaos and partial predictability — •Hendrik Wernecke, Bulcsú Sándor, and Claudius Gros — Goethe-Universität Frankfurt am Main, Institut für Theoretische Physik, Max-von-Laue-Straße 1, 60438 Frankfurt am Main

For deterministic dynamical systems the exponential divergence of pairs of initially close trajectories on the attracting set is a tell-tale indicator for chaos. This process can lead to a total loss of correlation within the time scale of the Lyapunov prediction time. However, there is a type of chaotic motion, for which the time scale of decorrelation is dominantly determined by a diffusive process on the attractor. This type of chaos stays partially predictable for remarkably long time. However, due to the high level of cross-correlation, the standard tests for chaos either yield ambiguous results or misclassify partially predictable chaos as laminar flow. Therefore we present in this study a novel indicator for chaos based on the cross-distance scaling of pairs of initially close trajectories. This test is capable of robustly and unambiguously distinguishing chaotic dynamics, including partially predictable chaos, from laminar flow in a 0-1 fashion. In combination with the finite-time cross-correlation, we are able to distinguish all three types of motion – chaos, partially predictable chaos and laminar flow – in a 0-1 manner from the time evolution of pairs of trajectories.

DY 59.2 Thu 17:00 P1A

Determining the free energy gain of phase separation via Markov state modelling — •Myra Biedermann and Andreas Heuer — Westfälische Wilhelms-Universität, Institut für Physikalische Chemie, Corrensstr. 28/30, 48149 Münster, Germany

Within the last two decades, Markov state modelling (MSM) has gained increased attention as a sampling method. On this basis a kinetic model can be built that describes the long-time statistical dynamics of a system by systematically collecting simulation data from trajectories that are significantly shorter than the longest relaxation time of the system. The development of MSMs has been largely driven by studies of protein folding and protein functionality. Here, we aim at expanding the application range of MSM towards studies of phase-separating systems such as e.g. raft-forming lipid bilayers. Because of the complexity of these types of systems, we discuss the general procedure for the Ising model with fixed concentration of up- and down-spins in the low-temperature limit.

Here, we present our results from application of MSM to the Ising model, including a study of the difficulties and problems that arise in the estimation process. We will show detailed investigations of the causes for these problems and present possible methods to circumvent, or rather account for them during the estimation process.

DY 59.3 Thu 17:00 P1A

Rodlike Localized States in a Swift-Hohenberg Model — •Felix Tabbert[1], Ignacio Bordeu[2], and Svetlana Gurevich[1] — [1]Institute for Theoretical Physics, Münster — [2]Imperial College, London

We study the existence of localized rodlike solutions in a Swift-Hohenberg model which have been reported in [1]. We provide a linear stability analysis and a bifurcation analysis in two dimensions of rodlike and other stationary solutions which bifurcate by breaking the rotational symmetry of a single localized solution. To this aim, we deploy numerical pathway continuation in two spatial dimensions in combination with direct numerical simulations. Since the Swift-Hohenberg equation possesses the same stationary solutions as the conserved Swift-Hohenberg equation, most of the results can also be applied to phase field crystal models of this type [2][3].

Further analysis includes the destabilization of the aforementioned solutions by time-delayed feedback leading to complex dynamics, e.g. drift or rotations. A stability analysis of the time-delayed system is also performed and shows good agreement with the results from direct numerical simulations.

[1] I. Bordeu and M. G. Clerc, Phys. Rev. E 92, 042915 (2015).
[2] A.M. Menzel and H. Löwen, Phys. Rev. Lett. 110, 055702 (2013).
[3] M.J. Robbins et al., Phys Rev E 85, 061408 (2012).

DY 59.4 Thu 17:00 P1A

Bifurcation analysis of a passively mode-locked semiconductor laser with optical feedback — •Lina Jaurigue[1] and Kathy Lüdge[1,2] — [1]Institut für Theoretische Physik, Technische Universität Berlin, Berlin, Germany — [2]Department of Mathematics, University of Auckland, Auckland, New Zealand

Passively mode-locked semiconductor lasers can exhibit a rich range of pulsed dynamics. The time scales of these dynamics are related to the roundtrip time of the laser cavity and the recovery times of carriers in the gain and absorber sections of the laser. Adding optical self-feedback to such system can strongly influence these dynamics which then depend crucially on the ratio of the internal time scales to the feedback delay time [1,2]. In this contribution we present an analysis of the dynamics and bifurcations of such a system, which we describe using a system of coupled delay differential equations involving multiple delay times [3,4].

[1] L. C. Jaurigue, O. Nikiforov, E. Schöll, S. Breuer, and K. Lüdge, Phys. Rev. E **93**, 022205 (2016).
[2] O. Nikiforov, L. C. Jaurigue, L. Drzewietzki, K. Lüdge, and S. Breuer, Opt. Express **24**, 14301–14310 (2016).
[3] A. Vladimirov and D. V. Turaev, Phys. Rev. A **72**, 033808 (2005).
[4] L. C. Jaurigue, PhD Thesis, Technische Universität Berlin (2016).