DY 20: Nonlinear Dynamics 1 - organized by Azam Gholami (Göttingen)

Time: Tuesday 9:00–10:00 Location: DYc

DY 20.1 Tue 9:00 DYc

Discrete light bullets in passively mode-locked semiconductor lasers — •Thomas Seidel[1,2], Svetlana V. Gurevich[2], and Julien Javaloyes[1] — [1]Dpt. de Física, Universitat de les Illes Balears & IAC-3, Campus UIB, E-07122 Palma de Mallorca, Spain — [2]Institute for Theoretical Physics & Center for Nonlinear Science (CeNoS), University of Münster, Schlossplatz 2, 48149 Münster, Germany

We study the emergence and stability of discrete light bullets in the output of a passively mode-locked semiconductor laser array coupled to a distant saturable absorber. First, we investigate the dynamics of the tranverse field which can be modeled by a discretised version of the generalised Rosanov equation and next, we also include the longitudinal direction and thus, show the existence of three-dimensional dissipative localized structures with one discrete (transverse) and two continuous (longitudinal) directions. In both situations, we observe multistability between solution branches consisting of a different number of lasing lasers by numerical time integration. For the transverse case, a detailed bifurcation analysis by means of path continuation was conducted in order to study the transition between different solution branches. Further, the existence of drifting solitons is demonstrated for both bright and dark localized structures.

DY 20.2 Tue 9:20 DYc

Laminar Chaos in Experiments: Nonlinear Systems with Time-Varying Delays and Noise — •David Müller-Bender[1], Andreas Otto[1], Günter Radons[1], Joseph D. Hart[2,3], and Rajarshi Roy[2,3,4] — [1]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [2]Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, Maryland 20742, USA — [3]Department of Physics, University of Maryland, College Park, Maryland 20742, USA — [4]Institute for Physical Science and Technology, University of Maryland, College Park, Maryland 20742, USA

A new type of dynamics called laminar chaos was discovered in systems with time-varying delay [1]. It is a low-dimensional dynamics characterized by laminar phases of nearly constant intensity with periodic durations and a chaotic variation of the intensity from phase to phase. This is in contrast to the typically observed higher-dimensional turbulent chaos, which is characterized by strong fluctuations. In this work [2], we demonstrate experimentally and theoretically that laminar chaos is a robust phenomenon. Therefore, we provide the first experimental observation of laminar chaos by studying an optoelectronic feedback loop with time-varying delay and provide a time-series analysis toolbox for its detection. The toolbox is benchmarked by experimental data and by time-series of a delayed Langevin equation.

[1] Müller, Otto, and Radons, Phys. Rev. Lett. 120, 084102 (2018).

[2] Hart, Roy, Müller-Bender, Otto, and Radons, Phys. Rev. Lett. 123, 154101 (2019).

DY 20.3 Tue 9:40 DYc

Non-local effects in external cavity passively mode-locked lasers — •Jan Hausen[1], Christian Schelte[2], Julien Javaloyes[2], Svetlana V. Gurevich[2,3], and Kathy Lüdge[1] — [1]TU Berlin, Hardenbergstrasse 36, 10623 Berlin — [2]Universitat de les Illes Balears & Institute of Applied Computing and Community Code, Cra. de Valldemossa, km 7.5. Palma (Illes Balears) — [3]WWU Münster, Wilhelm-Klemm-Strasse 9, 48149 Münster

Asymetrical cavity geometries can improve the performances of passively mode-locked vertical external-cavity surface-emitting lasers and give rise to non-equidistant pulse patterns. We show that these geometries create non-local effects; by analysing a previously developed delay differential equation model, we derive rigorously a master partial differential equation from the pulse evolution that contains such non-local terms. We extend our analysis to the dynamics of non-equidistant pulse patterns in the long cavity regime, in which the pulses become temporal localized structures. We study the influence of the non-locality stemming from the asymmetric position of the elements in the cavity on the pulse distance within these patterns and deduce an analytic framework. By performing a Floquet-analysis, we find that with increasing cavity round-trip times there is a continuous transition from bound pulse patterns to pulses which are globally bound by the non-local effects, but locally independent, similar to catenane molecules.