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Topic: Noise and Stochastic Processes

Control of noise-induced dynamics near a global bifurcation

J. Hizanidis[1*], A. G. Balanov[2], A. Amann[3], E. Schöll[4]

[1] Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Germany

[2] Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Germany,School of Physics and Astronomy, University of Nottingham, NG7 2RD, UK

[3] Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Germany,Tyndall National Institute, Lee Maltings, Cork, Ireland

[4] Institut für Theoretische Physik, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Germany

[*] Electronic Address: `hizanidis@physik.tu-berlin.de`

A nonlinear spatially extended system under the influence of noise and time-delayed feedback control is investigated. The model under consideration is a semiconductor superlattice [1] which exhibits complex front dynamics associated with high-frequency current oscillations in the ideal noise-free case. We expand the model taking into account fluctuations, which we approximate by Gaussian white noise [2]. Noise-induced front motion is reported, when the deterministic system is prepared in a stable fixed point slightly below a saddle-node bifurcation on a limit cycle [3]. This is a global bifurcation, strongly related to excitability and the presence of two time scales in the system. Coherence resonance is confirmed by the non-monotonic relation between the regularity of oscillations and the noise intensity. The ability to control the properties of the system such as timescales and coherence [4], is very interesting in terms of applications. We therefore subject the system to a time-delayed feedback scheme, originally used to control deterministic chaotic dynamics, and demonstrate that the regularity and the time scales can be controlled by varying the control strength and time delay.

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[3] J. Hizanidis, A. G. Balanov, A. Amann and E. Schöll *Phys. Rev. Lett.* **96**, 244104 (2006)

[4] N. B. Janson. A. G. Balanov and E. Schöll, *Phys. Rev. Lett.* **93**, 010601 (2004).