

Workshop
NONLINEAR DYNAMICS MEETS STOCHASTIC DYNAMICS
Erwin Schrödinger Institute for Mathematical Physics,
Vienna, Austria
18-22 April 2007

Organizers: Christoph Dellago (University of Vienna), Peter Hänggi (University of Augsburg), and Harald F. Kaufmann (University of Vienna)

Summary

The workshop “Nonlinear Dynamics Meets Stochastic Dynamics” funded by the European Science Foundation took place from April 18-20, 2007 at the Erwin Schrödinger Institute for Mathematical Physics in Vienna, Austria. More than 30 researchers from 10 countries working in the field of statistical physics participated in this workshop in a very active and lively way such that for all participants the workshop was a very fruitful and stimulating event.

The Erwin Schrödinger Institute (ESI), funded by the Austrian Federal Ministry of Science and Research and associated with the University of Vienna, is an institution whose mission is to foster development and exchange of ideas in the physics and mathematics communities on an international level. At ESI excellent meeting facilities including lecture halls, common rooms for individual discussions as well as personal desks and computer access for all visitors are available. The ESI staff handled all reimbursements and hotel reservations for the workshop participants.

To provide information on the theme of the workshop, the format of the workshop and the meeting place the organizers set up a webpage that is still available to the public at <http://comp-phys.univie.ac.at/destodyn>.

Most participants came to Vienna upon invitation by the organizers. A few additional people were admitted after they had applied to the organizers. All workshop participants were offered to bring along students and young collaborators so that they can get in touch with the international community. Only a few colleagues made use of this possibility.

Scientific content, discussions and impact

The workshop was organized in five sessions of four to five talks each. Both the lunch breaks and the coffee breaks interrupting the sessions were sufficiently long to promote direct personal interactions among the participants. The detailed scientific program including the titles of all contributions is appended to this document.

The stated goal of the meeting was to bring together researchers who address the physics of systems far from equilibrium in two different ways. One approach is to consider the deterministic time evolution of systems driven away from equilibrium by external perturbations. Often in this case thermostats are used to stabilize the system in non-equilibrium steady states. Such deterministic thermostats, which replace large heat baths by one or a few degrees and the related fractal phase space distributions were the topic of several talks and discussion of this workshop. In this context, configurational thermostats emerged as a particularly interesting new possibility to generating stationary states in an efficient way. Pulsed, non-linear spectroscopy 2D experiments on complex molecular systems, having their own high-dense vibrational reservoir, fall into the category of external perturbation, with a stochastic relaxation part coupled to a quantum-kernel. Such coherent-incoherent patterns are highly exciting and require intimate overlap between experimental relaxation and statistical mechanical non-equilibrium theory as discussed in the meeting.

The alternative way to describe non-equilibrium steady states and transport is to replace the heat bath by a random stochastic force that satisfies the fluctuation-dissipation theorem. A number of speakers reported about their work on the stochastic dynamics of various systems ranging from proteins to ion channels. Both areas have been strongly stimulated by the discovery of so called fluctuation theorems. These exciting and very general new results yield quantitative and exact descriptions of the fluctuations occurring in non-equilibrium processes and have consequences that can be tested in experiments. A whole session of the workshop was dedicated to these non-equilibrium fluctuation theorems and their application to various systems. The discussions about this topic continued at the conference dinner that took place at a traditional Viennese “Heurigen”.

Although the deterministic and stochastic communities have much in common, there is surprisingly little overlap between them. The organizers are confident that at this workshop some ties have been established between the two groups for the benefit of the field of non-equilibrium statistical mechanics.

The following people participated in the workshop:

Francisco J. Cao	(Complutense University of Madrid, Madrid, Spain)
Carl Dettmann	(University of Bristol, Bristol UK)
Christian Drobniwsky	(Technical University of Chemnitz, Chemnitz, Germany)

Werner Egger (University of the German Armed Forces, Munich, Germany)
Denis Evans (Australian National University, Canberra, Australia)
Luca Forte (University of Naples, Naples, Italy)
Giovanni Gallavotti (University of Rome “La Sapienza”, Rome, Italy)
Pierre Gaspard (Free University of Brussels, Brussels, Belgium)
Carol G. Hoover (Livermore National Laboratory, Livermore, USA)
William G. Hoover (Livermore National Laboratory, Livermore, USA)
Yossi Klafter (University of Tel Aviv, Tel Aviv, Israel)
Roberto Livi (University of Florence, Florence, Italy)
Manuel Morillo-Buzon (University of Seville, Seville, Spain)
David Mukamel (Weizmann Institute of Science, Rehovot, Israel)
Shaul Mukamel (University of California at Irvine, Irvine, USA)
Markus Niemann (MPI for complex systems, Dresden, Germany)
Günther Radons (Technical University of Chemnitz, Chemnitz, Germany)
Miguel Rubi (University of Barcelona, Barcelona, Spain)
Stefano Ruffo (University of Florence, Florence, Italy)
Lutz Schimansky-Geier (Humboldt University, Berlin, Germany)
Gerhard Schmid (Universität Augsburg, Augsburg, Germany)
Peter Talkner (Universität Augsburg, Augsburg, Germany)
Jacobus van Meel (Amolf Institute, Amsterdam, The Netherlands)
Angelo Vulpiani (University of Rome “La Sapienza”, Rome, Italy)

Local participants

Hadrien Bosetti (University of Vienna, Vienna, Austria)
Christina Forster (University of Vienna, Vienna, Austria)
Heide Narnhofer (University of Vienna, Vienna, Austria)
Gerhard Kahl (Technical University of Vienna, Austria)
Jürgen Köfinger (University of Vienna, Vienna, Austria)
Wolfgang Lechner (University of Vienna, Vienna, Austria)
Harald Oberhofer (University of Vienna, Vienna, Austria)
Harald Posch (University of Vienna, Vienna, Austria)
Elisabeth Schöll-Paschinger (University of Vienna, Vienna, Austria)
Walter Thirring (University of Vienna, Vienna, Austria)
Stefan Thurner (Medical University of Vienna, Vienna, Austria)
Andreas Tröster (University of Vienna, Vienna, Austria)
Emmerich Wilhelm (University of Vienna, Vienna, Austria)

Workshop Program

Wednesday, April 18

8:55-9:00	C. Dellago	Welcome and Introduction
9:00-9:40	W. G. Hoover	50 joint explorations, 1985-2007
9:40-10:20	P. Gaspard	Time-reversal symmetry breaking in nonequilibrium statistical mechanics
10:20-10:50	<i>Coffee break</i>	
10:50-11:30	M. Rubi	Towards the description of diffusion in confined media
11:30-12:10	R. Livi	Some news about heat transport in 1d systems
12:10-14:00	<i>Lunch break</i>	
14:00-14:40	W. Thirring	Emergence of order in classical and quantum mechanical evolution
14:40-15:20	S. Thurner	Derivation of an entropy for arbitrary distribution functions
15:20-15:50	<i>Coffee break</i>	
15:50-16:30	G. Radons	Configurational thermostats
17:10-17:50	M. Morillo-Buzon	Stochastic resonance and synchronization effects in finite sets of noisy, interacting, bistable subsystems

Thursday, April 19

9:00-9:40	G. Gallavotti	Thermostats and entropy in classical and quantum nonequilibrium
9:40-10:20	L. Schimansky-Geier	Coherence resonance in excitable and oscillatory devices
10:20-10:50	<i>Coffee break</i>	
10:50-11:30	D. Mukamel	Dynamics and thermodynamics of systems with long range interactions
11:30-12:10	S. Ruffo	Quasi-stationary states in mean-field dynamics
12:10-14:00	<i>Lunch break</i>	
14:00-14:40	D. J. Evans	The fluctuation & nonequilibrium free energy theorems, theory & experiment

14:40-15:20	P. Talkner	Fluctuation theorems: work is not an observable
15:20-15:50	<i>Coffee break</i>	
15:50-16:30	S. Mukamel	Fluctuation theorems for electron counting-statistics in quantum junctions
17:10-17:50	H. Oberhofer	Some computational aspects of the Jarzynski theorem
19:30	Conference Dinner	

Friday, April 20

9:00-9:40	Y. Klafter	Fractons in proteins
9:40-10:20	A. Vulpiani	Transport properties in chaotic and non-chaotic many particle systems
10:20-10:50	<i>Coffee break</i>	
10:50-11:30	G. Schmid	Channel noise reduction due to gating charge effects
11:30-12:10	F. J. Cao	Feedback control in Brownian ratchets: results and prospects

Posters

Jacobus van Meel “Lyapunov Instability of a System of hard dumbbells”

Christian Drobniowsky “Lyapunov modes in many-particle systems”