Max-Planck-Institut für Physik komplexer Systeme
Dresden, Germany

International Seminar and Workshop on
Weak Chaos, Infinite Ergodic Theory, and Anomalous Dynamics

Seminar: July 25 - 29 and August 8 - 12, 2011
Workshop: August 1 - 5, 2011

Scientific coordination:

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Organisation:

Katrin Lantsch

Weak chaos refers to systems exhibiting zero Lyapunov exponents, meaning that the separation of nearby trajectories is weaker than exponential. Still, the dynamics is typically very irregular. Rigorous mathematical results about such systems have recently been obtained by infinite ergodic theory, which is an extension of ordinary ergodic theory to dynamical systems with non-normalizable measures. These theoretical concepts predict novel nonequilibrium physical properties in form of anomalous dynamics, which can be tested in experiments.

The purpose of this conference is to initiate cross-disciplinary collaborations between physicists working on both the deterministic and the stochastic aspects of weakly chaotic systems and anomalous dynamics, and mathematicians being active in the relevant branches of dynamical systems and ergodic theory. The workshop will particularly bring together key players in both fields, the seminar will comprise a series of advanced lectures to provide review and training for young scientists, and to serve as a forum for informal discussions.

Scientific key topics are:

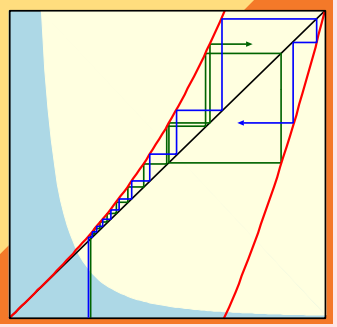
- **Dynamical systems theory of weak chaos:** pseudochaos, nonhyperbolic dynamics, entropy concepts for weak chaos, zero Lyapunov exponent, polygonal billiards, weakly chaotic diffusion
- **Infinite ergodic theory:** skew products, infinite invariant measures, distributional and functional limit theorems, mathematical billiards and Lorentz gas models, entropy, generalized ergodic theorems
- **Stochastic theory of anomalous dynamics:** continuous time random walks, anomalous diffusion, weak ergodicity breaking, fractional calculus, statistics of occupation times, anomalous fluctuation relations
- **Experimental applications:** anomalous statistics of blinking quantum dots, anomalous diffusion of atoms in optical lattices, anomalous biological dynamics, extreme events, detrended fluctuation analysis

List of invited speakers (* to be confirmed):

J. Aaronson (IL), Y. Aizawa (JP), E.G. Altmann (D), R. Artuso (IT), A. Bunde (D), L. Bunimovich (US), S. Burov (IL), A.V. Chechkin (UKR), A. Comtet (F), G. Cristadoro (IT), D. del Castillo-Negrete (US), P. Dieterich (D), R. Friedrich (D), T. Geisel (D), S. Gouezel (F), P. Hänggi (D), P. Howard (UK), G. Keller* (D), D. Kessler (IL), Y. Klafter (IL), N. Korabel (IL), E. Lutz (D), S. Majumdar (F), I. Melbourne (UK), R. Metzler (D), M. Niemann (D), G. Oshanin (F), T. Prellberg (UK), F. Renzoni (UK), A. Robledo (MEX), L. Rondoni (IT), B. Saussol* (F), H.P. Scheffler (D), I.M. Sokolov (D), D. Sornette (CH), D. Szasz* (HU), M. Thaler (A), F. Vivaldi (UK), A. Vulpiani (IT), L.-S. Young* (US)

Applications for participation and poster contributions are welcome and should be submitted by using the application form on the event's web page (please see URL below). The number of attendees is limited. The **registration fee** for the workshop is **120 €** and should be paid by all participants. Costs for accommodation and meals will be covered by the Max Planck Institute for the Physics of Complex Systems. Limited funding is available to partially cover travel expenses. Please note that childcare is available upon request.

Deadline for registration is March 31, 2011.



For further information please contact:
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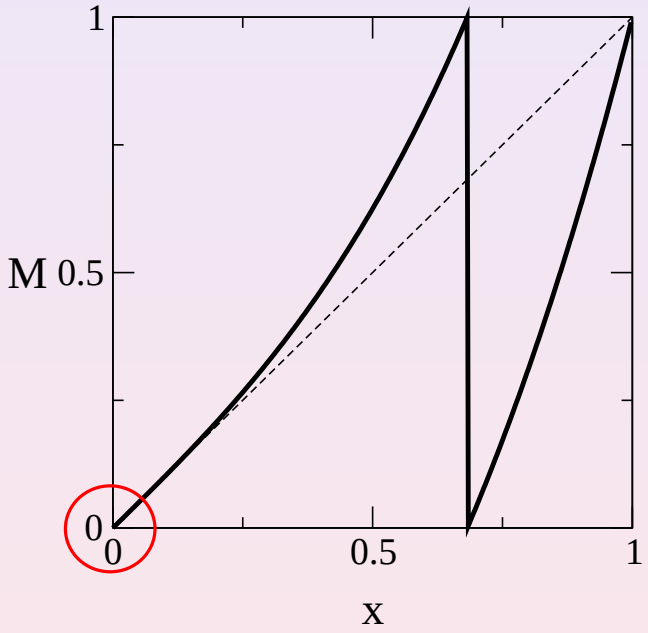
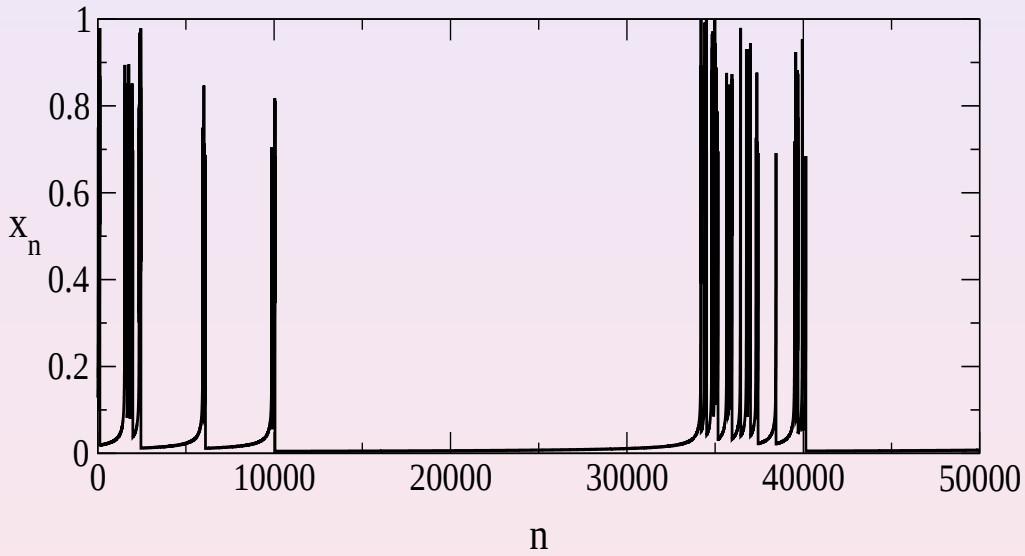
Anomalous dynamics

consider the nonlinear map (Pomeau, Manneville, 1980)

$$x_{n+1} = M(x_n) = x_n + x_n^{1+z} \mod 1\ ,\ z > 0$$





phenomenology of **intermittency**: long periodic *laminar phases* interrupted by *chaotic bursts*

here due to a marginally unstable fixed point, $M'(0) = 1$

Infinite ergodic theory

invariant density of this map calculated to

$$\varrho(x) \sim x^{-z} \ (x \to 0)$$

is non-normalizable for $z \geq 1$ yielding the **infinite invariant measure**

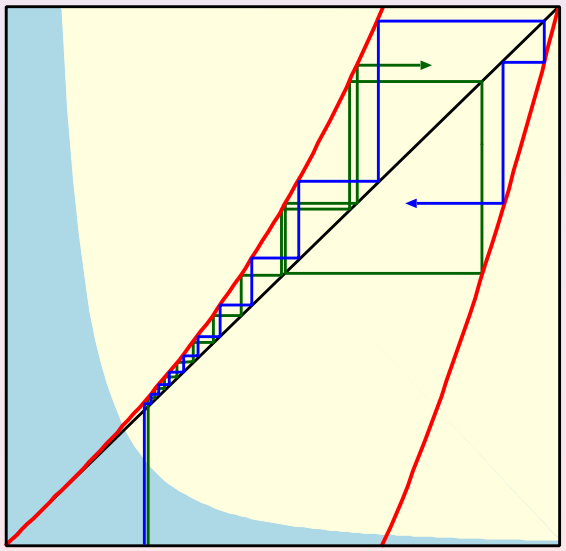
$$\mu(x) = \int_x^1 dy\, \varrho(y) \to \infty \ (x \to 0)$$

Weak chaos

dispersion of nearby trajectories calculated to

$$\Delta x_n \sim \exp\left(n^{\frac{1}{z}}\right) \ (z > 1)$$

grows weaker than exponential: **Ljapunov exponent** $\lambda = 0$



Scope of the conference