Workshop on
Infinite-dimensional dynamical systems and attractors
August 17th–21st 2020, Lanzhou University
Lanzhou, China

The aim of this Workshop is to bring together experts who works on diverse frontiers of Infinite-dimensional dynamical systems and their applications to survey recent progress and current challenges.

VooV/Tencentmeeting webinar links:
https://meeting.tencent.com/s/uiblXZGlvSTQ
Meeting ID: 642 6164 2331

Topics:
- Analysis of PDEs
- Dissipative Dynamics: Attractors; Inertial manifolds; Random dynamics, etc.
- Integral inequalities
List of invited speakers:
T. Dlotko (Silesian University, Poland)
V. Kalantarov (Koch University, Turkey)
P. Kloeden (Universität Tubingen, Germany)
A. Kostianko (Lanzhou University, China)
A. Ilin (Russian Academy of Sciences, Russia)
A. Miranville (Université de Poitiers, France)
D. Turaev (Imperial College London, UK)

Short Classes:
Sergey Zelik (Lanzhou University, China): Attractors in topological spaces and applications

Organizing Committee:
Anna Kostianko (Lanzhou University, a.kostianko@surrey.ac.uk)
Shan Ma (Lanzhou University, mashan@lzu.edu.cn)
Chunyou Sun (Lanzhou University, sunchy@lzu.edu.cn)
Sergey Zelik (Lanzhou University, s.zelik@surrey.ac.uk)
Chengkui Zhong (Nanjing University, ckzhong@nju.edu.cn)
Program: Beijing Time

| August 17th |
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| 15:40-16:00 | **Opening**: Chengkui Zhong |
| Time        | Speaker       | Title                              |
| 16:00-17:00 | Alain Miranville | Mathematical models for glial cells |
| 17:00-19:00 | Sergey Zelik  | Attractors in topological spaces and applications I |

| August 18th |
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| 16:00-17:00 | Dmitry Turaev | On triple instability |
| 17:00-19:00 | Sergey Zelik  | Attractors in topological spaces and applications II |

| August 19th |
|-------------|
| 16:00-17:00 | Tomasz Dlotko | Critical Parabolic Problems |
| 17:00-19:00 | Sergey Zelik  | Attractors in topological spaces and applications III |

| August 20th |
|-------------|
| 16:00-17:00 | Peter Kloeden | Mean-square random dynamical systems and mean-square dichotomies |
| 17:00-19:00 | Sergey Zelik  | Attractors in topological spaces and applications IV |

| August 21st |
|-------------|
| 16:00-17:00 | Alexey Ilyin  | Lieb-Thirring and Ladyzhenskaya inequalities on the 2d sphere and on the 2d torus |
| 17:00-18:00 | Varga K. Kalantarov | Asymptotic regularity and attractors for slightly compressible Brinkman-Forchheimer equations |
| 18:00-19:00 | Anna Kostianko | Lipschitz Mane projections and finite-dimensional reduction for complex Ginzburg-Landau equation |
Critical Parabolic Equations
TOMASZ DŁOTKO
University of Silesia in Katowice, Poland

We discuss the well-posedness and regularity for several parabolic-type equations. It based on our recent monograph *Critical Parabolic-Type Problems*, De Gruyter, 2020.

Asymptotic regularity and attractors for slightly compressible Brinkman-Forchheimer equations
VARGA K. KALANTAROV
Koç University, Istanbul; Azerbaijan State Oil and Industry University, Baku

The talk will be devoted to the initial boundary value problems for slightly compressible Brinkman-Forchheimer equations, modeling motion of fluids in porous media. in a bounded 3D domain with sufficiently smooth boundary under the homogeneous Dirichlet boundary condition. The dissipativity of the semigroup generated by the problem considered in higher order energy spaces is obtained, regularity and smoothing properties of solutions are studied. In addition, the existence of a global and an exponential attractors for the semigroup generated by the problem in a natural phase space is verified.

Mean-square random dynamical systems and mean-square dichotomies
PETER E. KLOEDEN
Mathematisches Institut, Universität Tübingen, D-72076 Tübingen, Germany

Mean-square random dynamical systems are essentially deterministic nonautonomous dynamical systems defined in terms of a two-parameter semigroup acting on a state space of mean-square random variables. Many concepts of nonautonomous dynamical systems such as pullback attractors carry over, but there are practical difficulties in applying the known results due to the lack of compactness criteria in such spaces. Such systems are generated by mean-field SDE, i.e., those involving expectations in their coefficients. The mean-square dichotomy spectrum and an example of bifurcation to a mean-square attractor will also be discussed.

References
[1] S.T. Doan, M. Rasmussen and P.E. Kloeden, The mean-square dichotomy spectrum and a bifurcation to a mean-square attractor, *Discrete Conts. Dyn. Systems, Series B* 20, (2015), 875–887.
[2] P.E. Kloeden and T. Lorenz, Mean-square random dynamical systems, *J.Differential Equations* 253 (2012), 1422–1438.
Lipschitz Mane projections and finite-dimensional reduction for complex Ginzburg-Landau equation

Anna Kostianko
Lanzhou University, China; Surrey University, UK

In this talk I will discuss the problem of the finite-dimensional reduction for 3D complex Ginzburg-Landau equation (GLE) with periodic boundary conditions. Using spatial averaging principle, which was introduced by J. Mallet-Paret and G. Sell to handle the 3D reaction-diffusion equations, together with temporal averaging we will be able to show that the attractor of our problem possesses Mané projections with Lipschitz continuous inverse. This work can be considered as the first step to proof the existence of an inertial manifold for GLE.

Lieb-Thirring and Ladyzhenskaya inequalities on the 2d sphere and on the 2d torus

Alexey A. Ilyin
Russian Academy of Sciences, Russia

We prove on the 2d sphere and on the 2d torus the Lieb–Thirring inequalities with improved constants for orthonormal families of scalar and vector functions. It is a joint work with A. Laptev and S. Zelik.

Mathematical models for glial cells

Alain Miranville
Université de Poitiers, France

Our aim in this talk is to discuss mathematical models for glial cells and energy metabolism in the brain. In particular we discuss the existence of global in times solutions for a Cahn-Hilliard type model.

On triple instability

Dmitry Turaev
Imperial College London, UK

It is well-known that bifurcations of a triply unstable equilibrium or a periodic orbit can lead to the emergence of chaotic dynamics. We show that the richness and complexity of these dynamics are unrestricted.