Workshop on Evolution Equations

This event is a small workshop on

<div align="center">

PDEs in physical systems

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that will be held on ***Wednesday June 7th, 2023***. Speakers will present new ideas and insights in the following directions:

non-equilibrium fluctuations, gaseous stars, compressible flows, and shallow water equations.

We hope this workshop can provide an opportunity for young researchers in PDEs to come together, exchange ideas, and potentially establish new collaborations.

Zoom link: https://uio.zoom.us/j/64235435949?pwd =NzJQZ3Q3TThrSHd0VTVoblpHdkxwQT09
Conference No.: 642 3543 5949
Password: 035279

Schedule

All the times refer to the *local Oslo time* in zone **GMT +1**[1]:

10:25-10:30 **Opening**.

10:30-11:10 **Speaker**: Benjamin Fehrman (*University of Oxford*).
Title: Non-equilibrium fluctuations and parabolic-hyperbolic PDE with irregular drift
Abstract: Non-equilibrium behavior in physical systems is widespread. A statistical description of these events is provided by macroscopic fluctuation theory, a framework for non-equilibrium statistical mechanics that postulates a formula for the probability of a space-time fluctuation based on the constitutive equations of the system. This formula is formally obtained via a zero noise large deviations principle for the associated fluctuating hydrodynamics, which postulates a conservative, singular stochastic PDE to describe the system far-from-equilibrium. In this talk, we will focus particularly on the fluctuations of the zero range process about its hydrodynamic limit. We will show how the associated MFT and fluctuating hydrodynamics lead to a class of conservative SPDEs with irregular coefficients, and how the study of large deviations principles for the particles processes and SPDEs leads to the analysis of parabolic-hyperbolic PDEs in energy critical spaces. The analysis makes rigorous the connection between MFT and fluctuating hydrodynamics in this setting, and provides a positive answer to a long-standing open problem for the large deviations of the zero range process.

11:10-11:15 **Q & A**.

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[1]Note that the China is 6 hours ahead of Oslo.

11:15-11:55 **Speaker**: Yan-Lin Wang (*Yau Mathematical Sciences Center, Tsinghua University*).
Title: Nonlinear asymptotic stability of the hydrostatic equilibrium for some gaseous stars with vacuum free boundary.
Abstract: The motion of gaseous stars in physical vacuum exhibit the moving boundary and the degeneracy of density, which bring difficulties in mathematical analysis. In this talk, the global existence theory for free boundary problems of some gaseous stars will be investigated using weighted energy method. Moreover, the nonlinear asymptotic stability of the hydrostatic equilibrium for these stars including viscous polytropes and white dwarfs, and some inviscid polytropic stars with (without) damping and solid core will be verified under suitable assumptions.

11:55-12:00 **Q & A**.

12:00-13:00 **Break**.

13:00-13:40 **Speaker**: Hua Zhong (*Southwest Jiaotong University*).
Title: Large-time behavior to compressible fluid dynamics equations on exterior domains
Abstract: In this talk, we will introduce some results about the initial boundary value problems for compressible Navier-Stokes-Poisson equations and MHD equations on exterior domains. With the radial symmetry assumption, the global existence of solutions to compressible Navier-Stokes-Poisson equations with the large initial data on a domain exterior to a ball in n-dimensional space ($n \geq 1$) is proved. For an exterior domain in three-dimensional space, without any symmetry assumption, the global existence of smooth solutions near a given constant steady state for compressible Navier-Stokes-Poisson equations with physical boundary conditions is also established with the exponential stability. Furthermore, an initial boundary value problem for compressible Magnetohydrodynamics (MHD) equations is considered on an exterior domain (with the first Betti number vanishes) in 3D case. The global existence of smooth solutions near a given constant state for compressible MHD with the boundary conditions of Navier-slip for the velocity filed and perfect conduction for the magnetic field is established with the algebraic stability. This work is jointed with Prof. Hairong Liu and Prof. Tao Luo.

13:40-13:45 **Q & A**.

13:45-14:25 **Speaker**: Ola Mæhlen (*University of Oslo*).
Title: One-sided Hölder conditions for solutions of weakly dispersive equations
Abstract: We prove global existence, uniqueness and stability of entropy solutions with L^2 initial data for a general family of negative order dispersive equations. These weak solutions are found to satisfy one-sided Hölder conditions whose coefficients decay in time. The latter result controls the height of solutions and further provides a way to bound the maximal lifespan of classical solutions from their initial data. This is joint work with Jun Xue (NTNU).

14:25-14:30 **Q & A**.

14:30-14:35 **Concluding remarks**.