



North-East and Midlands Stochastic Analysis Seminar supported by *Isaac Newton Institute for Mathematical Sciences*

Organisers: Zdzislaw Brzezniak (York), Horatio Boedihardjo (Warwick), David Elworthy (Warwick), Chunrong Feng (Durham), Maximiliano Gubinelli (Oxford), Zhongmin Qian (Oxford), Roger Tribe (Warwick), Huaizhong Zhao (Durham)

Programme (Venue: MCS2068, Department of Mathematical Sciences)

Friday 17 July 2026

11:00-12:00 **Xuhui Peng (Hunan Normal University)**

Ergodicity for 2D Navier-Stokes equations with a degenerate pure jump noise

12:30-14:00 Lunch at the MCS building ground floor

14:15-15:15 **Xiangdong Li (AMSS, Chinese Academy of Sciences)**

Some geometric and probabilistic reflections of the Navier-Stokes equations

15:15-16:15 **Martin Rasmussen (Imperial College)**

Conditioned Lyapunov exponents for random dynamical systems

16:15-16:45 Tea and coffee break

16:45-17:45 **Zhaosheng Feng (University of Texas-RGV)**

Parabolic System of Aggregation Formation in Bacterial Colonies

If you have any queries, please contact Chunrong Feng (chunrong.feng@durham.ac.uk) or Huaizhong Zhao (huaizhong.zhao@durham.ac.uk).

Titles and Abstracts

Xuhui Peng (Hunan Normal University)

Title: Ergodicity for 2D Navier-Stokes equations with a degenerate pure jump noise

Abstract: *We establish the ergodicity for stochastic 2D Navier-Stokes equations driven by a highly degenerate pure jump Levy noise. The noise could appear in as few as four directions. The case of Gaussian noise was treated in Hairer and Mattingly [Ann. of Math., 164(3):993--1032, 2006]. To obtain the uniqueness of invariant measure, we use Malliavin calculus and anticipating stochastic calculus to establish the equi-continuity of the semigroup, the so-called e-property, and prove some weak irreducibility of the solution process. This talk is based on a joint work with Jianliang Zhai and Tusheng Zhang.*

Xiangdong Li (AMSS, Chinese Academy of Sciences)

Title: Some geometric and probabilistic reflections of the Navier-Stokes equations

Abstract: *The existence of global smooth solutions to the three-dimensional incompressible Navier–Stokes equations is one of the famous Millennium Prize problems. In recent years, inspired by the geometric description of incompressible Euler equations on compact manifolds given by V. I. Arnold in 1966 and related works, we have used the Bellman dynamic programming principle on the infinite-dimensional group of volume-preserving diffeomorphisms to provide a new characterization of the incompressible Navier–Stokes equations on compact manifolds. In this report, we will present the relevant results of this study. In connection with this work, we will explore some geometric and probabilistic reflections on the deep relationships between the Hodge theory and Malliavin calculus on the infinite-dimensional group of volume-preserving diffeomorphisms as well as the Navier–Stokes equations.*

Martin Rasmussen (Imperial College)

Title: Conditioned Lyapunov exponents for random dynamical systems

Abstract: *We introduce the notion of conditioned Lyapunov exponents for random dynamical systems, where we condition on trajectories that stay within a bounded domain for asymptotically long times. This is motivated by the desire to characterise local dynamical properties in the presence of unbounded noise (when almost all trajectories are unbounded). We present two different approaches to prove the existence of such conditioned Lyapunov exponents, and both approaches make use of recent developments on quasi-stationary and quasi-ergodic measures.*

Zhaosheng Feng (University of Texas-RGV)

Title: Parabolic System of Aggregation Formation in Bacterial Colonies

Abstract: *In this work, we introduce a nonlinear parabolic system with dispersion to describe bacterial aggregation dynamics. In contrast to the corresponding model without dispersion, the inclusion of dispersion permits the propagation of bacterial clusters, indicating that dispersion can act as a regulatory mechanism for bacterial colony behavior. An analytical expression for the traveling-wave solution is derived by explicitly accounting for the dispersion coefficient. Numerical simulations further demonstrate that an initially random bacterial concentration evolves into a periodic wave pattern, which subsequently transitions into a stationary solitary wave in the absence of dispersion.*