North-East and Midlands Stochastic Analysis Seminar

Organisers: Z. Brzeźniak (York), H. Boedihardjo, K. D. Elworthy and R. Tribe (Warwick),
C. Feng and H.Z. Zhao (Durham), M. Gubinelli and Z. Qian (Oxford)

Wednesday 18th June 2025

All talks are in Zeeman Building, University of Warwick

Wednesday 18 June

14:30-15:30 **Paweł Duch (EPFL)**
Ergodicity of infinite volume Φ^4_3 model at high temperature

15:30-16:00 **Coffee Break**

16:00-17:00 **Matthew Jenssen (King's College London)**
A new lower bound for the Ramsey number $R(3,k)

For more information on speakers and events please visit:
North-East and Midlands Stochastic Analysis Seminars 2025

Kindly supported by Isaac Newton Institute and the London Mathematical Society.

Title and Abstract

Paweł Duch (EPFL)

Title: Ergodicity of infinite volume Φ^4_3 model at high temperature

Abstract: The dynamical Φ^4_3 model is a stochastic partial differential equation that arises in quantum field theory and statistical physics. Due to the singularity of the white noise and the presence of a nonlinear term, the equation is inherently ill-posed. However, it can be made sense of using, for example, the framework of regularity structures. By general results concerning the support and strong Feller property of singular stochastic PDEs on compact domains, the dynamical Φ^4_3 model on a torus admits a unique invariant measure. In contrast, establishing the uniqueness of the invariant measure in infinite volume is considerably more challenging. Even for the lattice version of the model, uniqueness holds only in the high-temperature regime, due to the occurrence of a phase transition.

We develop a solution theory for the dynamical Φ^4_3 model in infinite volume that yields a Feller--Markov process. We prove that, provided the mass is sufficiently large or the coupling constant sufficiently small (i.e., in the high-temperature regime), the process admits a unique invariant measure. We also show that in this parameter

regime, solutions of the dynamical Φ^4_3 model converge exponentially fast to the stationary solution, uniformly over initial conditions. These results imply, in particular, that the Φ^4_3 measure is invariant under translations, rotations, and reflections, and exhibits exponential decay of correlations.
Joint work with Martin Hairer, Jaeyun Yi and Wenhao Zhao.

Matthew Jenssen (King's College London)

Title: A new lower bound for the Ramsey number's $R(3,k)$

Abstract: Ramsey theory is a central topic in combinatorics whose philosophy can be broadly summarised as follows: any large structure must contain a well-organised substructure. In this talk I will give a brief introduction to Ramsey numbers, focusing on the past 90 years of progress in understanding the Ramsey numbers $R(3,k)$. I will then discuss some recent progress on lower bounds for $R(3,k)$. Here the task is to construct triangle-free graphs with no large independent sets. A natural and effective way to do this is to design a stochastic process which produces a 'quasi-random' graph with no triangles. In this talk I will discuss a novel stochastic process for producing triangle-free graphs which includes a twist that introduces additional structure part way through the process. The result is a denser triangle-free graph that is still sufficiently pseudo-random to have no large independent sets.
This is joint work with Marcelo Campos, Marcus Michelen and Julian Sahasrabudhe.