2025 Clifford Lectures and Conference

on Stochastic Analysis and PDE

Tulane University, New Orleans

February 11-14, 2025

Contents

1. Conference Schedule

Day 1: Tuesday, February 11th, 2025

5:00–6:00 PM **Clifford Lecture #1 – Public Lecture**

Speaker: Martin Hairer I
Location: Richardson Building – Room 117

6:00–8:30 PM **Welcome Reception**

Location: Lavin-Bernick Center – 1834 Club (2nd floor)

Day 2: Wednesday, February 12th, 2025

Note: All lectures on this day are held at Loyola's Campus

9:00–10:00 AM **Clifford Lecture #2**

Speaker: Martin Hairer II
Location: Miller Hall – Room 114 (Loyola)

10:00–10:30 AM **Coffee Break**

10:30–11:30 AM **Plenary Talk**

Speaker: Jacob Bedrossian
Location: Miller Hall – Room 114 (Loyola)

11:30–12:30 PM **Plenary Talk**

Speaker: Alex Blumenthal
Location: Miller Hall – Room 114 (Loyola)

12:30–2:00 PM **Lunch Break**

2:00–2:30 PM **Short Talk**

Speaker: Mickey Salins
Location: Miller Hall – Room 114 (Loyola)

2:30–3:00 PM **Short Talk**

Speaker: Cole Graham

Location: Miller Hall – Room 114 (Loyola)

3:00–3:30 PM **Coffee Break**

3:30–4:30 PM **Plenary Talk**

Speaker: Konstantin Matetski
Location: Miller Hall – Room 114 (Loyola)

7:00 PM **Conference Dinner**

Location: Calcasieu, 930 Tchoupitoulas St
RSVP required

Day 3: Thursday, February 13th, 2025

9:00–10:00 AM **Clifford Lecture #3**

Speaker: Martin Hairer III
Location: Lavin-Bernick Center – Rechler Room 202

10:00–10:30 AM **Coffee Break**

10:30–11:30 AM **Plenary Talk**

Speaker: Jonathan Mattingly
Location: Lavin-Bernick Center – Rechler Room 202

11:30–12:30 PM **Plenary Talk**

Speaker: Kavita Ramanan
Location: Lavin-Bernick Center – Rechler Room 202

12:30–2:00 PM **Lunch Break**

2:00–2:30 PM **Short Talk**

Speaker: Keefer Rowan
Location: Lavin-Bernick Center – Rechler Room 202

2:30–3:00 PM **Short Talk**

Speaker: Tommaso Rosati

Location: Lavin-Bernick Center – Rechler Room 202

3:00–3:30 PM **Coffee Break**

3:30–4:30 PM **Plenary Talk**

Speaker: Hao Shen
Location: Lavin-Bernick Center – Rechler Room 202

4:30–5:30 PM **Open Problem Session / Group Discussion**

Day 4: Friday, February 14th, 2025

9:00–10:00 AM **Plenary Talk**

Speaker: Sandra Cerrai
Location: Goldring-Woldenberg Building – Room 280

10:00–10:30 AM **Coffee Break**

10:30–11:00 AM **Short Talk**

Speaker: Giulia Carigi
Location: Goldring-Woldenberg Building – Room 280

11:00–12:00 PM **Plenary Talk**

Speaker: Michele Coti Zelati
Location: Goldring-Woldenberg Building – Room 280

12:00–1:30 PM **Lunch**

Afternoon **Planned Activity**

Food and Drinks / Music / Architecture Tour / Something of the sort

2. Talk Details

Clifford Lectures

Martin Hairer Public Lecture I
EPFL
Title: On Coin Tosses, Atoms, and Forest Fires
Abstract: In this lecture, we will encounter some of the mathematical objects arising naturally in probability theory, as well as some of their surprising properties. In particular, we will see how one of them was involved in the confirmation of the existence of atoms over 100 years ago and how new properties of related objects are still being discovered today.

Martin Hairer Lecture II
EPFL
Title: TBA
Abstract: TBA

Martin Hairer Lecture III
EPFL
Title: TBA
Abstract: TBA

Plenary Talks

Jacob Bedrossian
University of California, Los Angeles
Title: TBA
Abstract: TBA

Alex Blumenthal
Georgia Tech
Title: Sparsity of Fourier mass for passively advected scalars in Batchelor's regime
Abstract: In 1959, Batchelor gave a prediction for the power spectral density of a passively advected scalar acted on by incompressible transport, molecular diffusion, and forcing. A cumulative version of Batchelor's law was proved recently in the case of transport by the stochastic Navier Stokes equations on a periodic torus. However, this leaves open the extent to which Fourier mass of passive scalars actually fills out frequency space. In this talk I will describe recent joint work with Manh Khang Huynh (GT) concerning the surprising sparsity of Fourier mass in a toy model – pulsed diffusion – in a discrete-time version of passive scalar advection, and what one might expect regarding the sparsity or density of Fourier mass of passive scalars.

Sandra Cerrai
University of Maryland
Title: TBA
Abstract: TBA

Michele Coti Zelati
Imperial College London
Title: TBA
Abstract: TBA

Konstantin Matetski
Michigan State University
Title: TBA
Abstract: TBA

Jonathan Mattingly
Duke University
Title: TBA
Abstract: TBA

Kavita Ramanan
Brown University
Title: An H-theorem for a class of conditional McKean-Vlasov processes
Abstract: We consider conditional McKean-Vlasov processes that arise in the study of hydrodynamic limits of interacting diffusions on random regular graphs. We establish an H-theorem that characterizes the long-time behavior of these processes. Specifically, we show that a certain function related to the limit of certain renormalized relative entropies serves as a global Lyapunov function for the associated measure flow. We also provide counterexamples to highlight some subtleties in the approach, and discuss some open problems. This is joint work with Kevin Hu.

Hao Shen
University of Wisconsin-Madison
Title: Langevin dynamics of lattice Yang-Mills
Abstract: Lattice Yang-Mills or lattice gauge theory are natural lattice models where the field takes values in a matrix group. There are some important questions, such as exponential decay of correlations (mass gap), and uniqueness of infinite volume limit. The Langevin dynamics, or so called stochastic quantization, can be exploited to obtain results in these directions, in a large coupling regime. If time permitted, I will also discuss more general models, such as lattice Yang-Mills coupled with Higgs fields. Based on joint work with Rongchan Zhu and Xiangchan Zhu.

Short Talks

Giulia Carigi
Indiana University
Title: Ergodicity of a Stochastic Energy Balance Model for Global Temperature
Abstract: A simple yet extremely valuable approach to the study of the climate system comes from the use of Energy Balance Models (EBMs). Such models describe the key features of the zonally averaged temperature on the Earth's surface. The classical EBM can be improved by

increasing the vertical resolution. This talk presents a two-layer energy balance model that allows for vertical exchanges between a surface layer and the atmosphere. Considering random perturbations of the model will allow to better study its long-time average behaviour. Thanks to the weak Harris' theorem we will establish exponential ergodicity. This is a first step to study the model dependence on different forcing scenarios via response theory.

Cole Graham
University of Wisconsin-Madison
Title: Flowing across scales in the 2D stochastic heat equation
Abstract: The stochastic heat equation is critical in spatial dimension two: noise at many different scales influences the solution. In this talk, I will explore this multi-scale structure through a renormalization group analysis. This approach flexibly handles nonlinear noise and offers insights into pointwise statistics and macroscopic fluctuations. This represents joint work with Alex Dunlap.

Tommaso Rosati
University of Warwick
Title: TBA
Abstract: TBA

Keefer Rowan
Courant Institute, NYU
Title: Passive tracers advected by 2D Navier–Stokes equations with degenerate stochastic forcing
Abstract: I provide a high-level discussion of recent work with William Cooperman in which we prove the presence of various passive tracer phenomena in the physical model of a fluid with large-scale stirring given by the 2D Navier–Stokes equations with a degenerate stochastic forcing. This model was considered in the groundbreaking work of Hairer and Mattingly '06. The passive tracer phenomena were proved for the case of non-degenerate forcing by Bedrossian, Blumenthal, and Punshon-Smith '21, '22, '22. Our work can be viewed as a union of these frameworks.

Mickey Salins
Boston University
Title: Superlinear multiplicative noise can cause or prevent explosion in SPDEs
Abstract: This talk outlines some recent results about finite time explosion for the stochastic heat equation exposed to both superlinear determinisitc forcing terms and superlinear multiplicative noise coefficients. I will show that if the multiplicative noise coefficient grows sufficiently quickly, then the L^1 norm of the solutions stays finite. If the multiplicative noise coefficient grows too quickly, however, it can cause the L^∞ norm of solutions to reach infinity in finite time.