

A U S H A N G

FREIE UNIVERSITÄT BERLIN

Fachbereich Mathematik und Informatik

Promotionsbüro, Arnimallee 14, 14195 Berlin

D I S P U T A T I O N

Montag, 28. April 2025, 16:00 Uhr

Ort: Seminarraum 031

(Fachbereich Mathematik und Informatik, Arnimallee 6, 14195 Berlin)

Disputation über die Doktorarbeit von

Dennis Chemnitz

Thema der Dissertation:

Stability of Random Dynamical Systems in Noisy Oscillators with Shear and in Stochastic Gradient Descent

Thema der Disputation:

Recent Developments in the Mixing of Passive Scalars in Stochastic Fluid Flows

Die Arbeit wurde unter der Betreuung von **Dr. M. Engel** durchgeführt.

Abstract: Understanding the nature of turbulence occurring in three-dimensional high Reynolds number fluid flows is one of the major open problems in continuum mechanics. In particular, the Kolmogorov - 5/3 scaling, which predicts the energy distribution of a turbulent fluid flow over high Fourier modes, is wide open. A related but mathematically more tractable problem concerns the Fourier mass distribution of the solution to an advection-diffusion equation for which the advection vector field is given by a turbulent fluid flow. Such an equation models the evolution of passive scalars such as, e.g., the concentration of particles dissolved in the fluid or the temperature of the fluid. Depending on the ratio of the Reynolds number and the diffusivity, different scaling constants have been conjectured. In a series of papers published between 2021 and 2024, Jacob Bedrossian, Alex Blumenthal and Sam Punshon-Smith made significant progress in understanding this scaling for passive scalars driven by stochastic fluid flows in the so-called Batchelor regime which concerns the zero diffusivity limit for constant Reynolds numbers. Their methods are based on techniques from the theory of random dynamical systems and have sparked a new interest in the field. In this talk I will give a brief overview of the problem and the methods used by the aforementioned authors. Only a rudimentary knowledge of stochastic analysis, dynamical systems and partial differential equations is required to follow the talk.

Die Disputation besteht aus dem o. g. Vortrag, danach der Vorstellung der Dissertation einschließlich jeweils anschließenden Aussprachen.

Interessierte werden hiermit herzlich eingeladen

Der Vorsitzende der Promotionskommission
Dr. M. Engel