HAUSDORFF RESEARCH INSTITUTE FOR MATHEMATICS

UNIVERSITÄT BONN

Workshop on

"New Frontiers in Singular SPDEs and Scaling Limits"

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organized by

Giuseppe Cannizzaro (Warwick), Aya Chandra (London), Dirk Erhard (Salvador), Hao Shen (Wisconsin), Baris Evren Ugurcan (Bonn)

Abstracts

Tadahiro Oh (University of Edimburgh)

Singular stochastic nonlinear wave equations

Abstract: In this lecture series, I will go over recent developments in the well-posedness theory of singular stochastic nonlinear wave equations (SNLW) in two and three spatial dimensions. I will first go over the Wick renormalization and local well-posedness of SNLW in the two-dimensional case. Then, I will discuss some details of a globalization argument for the 2-d cubic SNLW. Then, I will discuss a more recent work on the paracontrolled approach to the three-dimensional SNLW with the quadratic nonlinearity by introducing paracontrolled operators. If time permits, I will go over the case of the 3-d SNLW with the cubic nonlinearity of Hartree-type and discuss how paracontrolled operators also appear in this case.

Felix Otto (Max Planck Institute Leipzig)

Singular quasi-linear stochastic PDEs

Abstract: We are interested in parabolic differential equations $\partial_t u - a(u)\partial_x^2 u = \xi$ with rough, typically random, forcing ξ, and a local non-linearity $a(u)$ in the leading order term. In terms of scaling, the interaction of this non-linearity with the roughness of ξ is as singular as for the non-linearity given by multiplicative noise, i. e. $\partial_t u - \partial_x^2 u = \sigma(u)\xi$. However, its treatment, for instance in the framework of controlled rough paths or of regularity structures, requires more care and some twists.

Within the setting of regularity structures, we present a framework that on the deterministic side is able to treat exponents down to a just positive Hölder exponent α of u. Key ingredients are the identification of the (infinite-dimensional) structure group and the connection to Safonov's kernel-free, jet-based approach to Schauder theory. This is joint work with H. Weber, J. Sauer, and S. Smith.

Fabio Toninelli (Universitè Claude Bernard Lyon 1)

$(2+1)$-dimensional growth and Anisotropic KPZ class

Abstract: These lectures will discuss 2+1-dimensional stochastic growth models and I will focus on those belonging to the so-called Anisotropic KPZ universality class, whose large-scale behaviour is analogous to that of the Stochastic Heat Equation with additive noise. I will mainly present discrete (lattice) models, e.g. the domino shuffling algorithms and the Borodin-Ferrari process on interlacing arrays.

- A. Borodin, F. L. Toninelli,Two-dimensional Anisotropic KPZ growth and limit shapes, J. Stat. Mech. (2018) 083205
- F. L. Toninelli, (2 + 1)-dimensional interface dynamics: mixing time,hydrodynamic limit and Anisotropic KPZ growth, Proceedings of theInternational Congress of Mathematicians 2018, Rio de Janeiro, vol. 2(2719-2744), arXiv:1711.05571
- F. L. Toninelli,A (2+1)-dimensional growth process with explicit sta-tionary measures, Annals of Probability 45 (2017), 2899–2940.

Nikolaos Zygouras (University of Warwick)

The 2d KPZ as a marginally relevant disordered system

Abstract: I will describe a series of work, joint with Francesco Caravenna and Rongfeng Sun, which make some first steps towards the understanding of scaling limits of disordered systems in a suitable weak disorder regime, where disorder has a so-called marginally relevant effect. This includes some first understanding of the KPZ equation in two space dimensions, which in the language of SPDEs is the "critical dimension". Among the results that we will describe is a phase transition and the identification of the KPZ solution below a critical temperature, which falls into the Edwards-Wilkinson universality class. Emphasis will be given on the methods which include Lindeberg principles, fourth moment theorems, analysis on Wiener spaces, multiscale analysis etc.
