Workshop Junior female researchers in probability

Berlin

5^{th} October – 7^{th} October 2022

Contents

1. Welcome

On behalf of the IRTG 2544 it is our great pleasure to welcome you to the workshop **Junior female researchers in probability**. We hope you enjoy illustrative talks and an interactive and inspiring exchange and networking.

Conference organisers
Peter Bank (TU Berlin), Dörte Kreher (HU Berlin), Laura Körber (TU Berlin), Helena Kremp (FU Berlin), Alexandra Quitmann (WIAS Berlin), Isabell Vorkastner (TU Berlin), Weile Weng (TU Berlin), Maite Wilke Berenguer (HU Berlin)

Venue
The workshop will take place in presence in Berlin. The address is

Tieranatomisches Theater (Veterinary Anatomy Theatre)
Humboldt-Universität zu Berlin
Campus Nord, Haus 3
Philippstr. 13
10115 Berlin

For more information about the venue, you can visit `https://tieranatomisches-theater.de`.

Presentations
The talks of the keynote and invited speakers each last one hour and the contributed talks each last 20 minutes including questions.

Supporters

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2. Keynote talks

2.1 Multiscale eco-evolutionary models: from individuals to populations, *Sylvie Méléard, École Polytechnique*

Motivated by recent biological experiments, we emphasize the effects of small and random populations on long time population dynamics. We will quantify such effects on macroscopic approximations. The individual behaviors are described by the mean of a stochastic measure-valued process. We study different long time asymptotic behaviors depending on the assumptions on mutation size and frequency and on horizontal transmission rate. In some cases, simulations indicate that these models should exhibit surprising asymptotic behaviors such as cyclic behaviors. We explore these behaviors on a simple model where population and time sizes are on a log-scale. Explicit criteria are given to characterize the possible asymptotic behaviors. The impact of the time and size scales on macroscopic approximations is also investigated, leading to Hamilton-Jacobi equations.

2.2 An introduction to reinforced processes , *Silke Rolles, TU Munich*

Processes with reinforcement have been extensively studied since the late 1980s. I will present results on two particular processes: the linearly edge-reinforced random walk and the vertex-reinforced jump process. First, we will focus on Polya's urn process, study its exchangeability and apply de Finetti's theorem. Then, we will look at an analogous property of the edge-reinforced random walk, namely partial exchangeability, and apply de Finetti's theorem for Markov chains to see that the process is a mixture of reversible Markov chains. Moreover, I will introduce the vertex-reinforced jump process and show its connection to the edge-reinforced random walk. In the last part of the talk, I will present results on the edge-reinforced random walk and the vertex-reinforced jump process and indicate some of the methods used in the study of these processes.

3. Invited talks

3.1 Random walks on a Lévy-type random media , *Alessandra Bianchi, University of Padua*

We consider a one-dimensional process in random media that generalizes a model known in the physical literature as Levy-Lorentz gas. The medium is provided by a renewal point process in which the inter-distances between points are i.i.d. heavy-tailed random variables, while the dynamics is obtained as the linear interpolation of - possibly long jump - random walks on the point process. These models have been used to describe phenomena that exhibit superdiffusion, and the main focus of this investigation is on the derivation of the scaling behavior of the process as a function of the parameters that enter its definition. We give an account on a number of recent theorems, which include non-standard functional limit theorems for the process in discrete and continuous time, and a comparison between the annealed and the quenched settings. We conclude by discussing possible future directions and some open problems.

3.2 F-KPP equations and the Feynman-Kac formula, *Lisa Hartung, Johannes Gutenberg University Mainz*

I will start by introducing the F-KPP equation, which is a reaction-diffusion equation that admits travelling wave solutions. Next, I will explain why the Feynman-Kac formula is a good tool to understand the longtime behaviour of solutions to this equations. If time permits, I will also comment on a recent application (joint with A. Bovier) of the is technique for a certain system of coupled F-KPP equations.

3.3 Bifurcation theory for stochastic (partial) differential equations, *Alexandra Neamtu, University of Konstanz*

Detecting bifurcation points for stochastic partial differential equations is a subtle task, because even for finite-dimensional stochastic systems the question of how to describe a bifurcation is not fully answered. There are several concepts of bifurcations, which can lead to different results. For instance, using order-preserving random dynamical systems, the famous result by Crauel and Flandoli indicates that additive noise destroys a pitchfork bifurcation. However, we show that even in the presence of additive noise a phenomenological bifurcation still occurs. This can be explained by a different qualitative behavior of the equilibrium before and after the bifurcation and it can be quantified by finite-time Lyapunov exponents. This talk is based on a joint work with Alex Blumenthal (Georgia Tech, USA) and Maximilian Engel (Free University of Berlin).

3.4 Financial equilibrium with limited participation, *Kim Weston, Rutgers, the State University of New Jersey*

A limited participation economy models the real-world phenomenon that some investors have access to more of the financial market than others. We model a limited participation economy through a financial equilibrium, where investor preferences and trading constraints are taken as model inputs, and prices and investment strategies are outputs. Such equilibrium models are described by a system of equations, and in this case, the equilibrium is characterized by a system of coupled, quadratic backward stochastic differential equations (BSDEs). We prove that the characterizing BSDE system has a unique $\mathscr{S}^{\infty} \times \mathrm{bmo}$ solution by using a key linear transformation of the BSDE system to a new system that is diagonally quadratic. This work generalizes the model of Basak and Cuoco (1998) to allow for a stock with a general dividend stream and exponential preferences.

4. Contributed talks

4.1 Reducing Obizhaeva-Wang type trade execution problems to LQ stochastic control problems, *Julia Ackermann, University of Gießen*

Trading large volumes can have a substantial adverse impact on the price. In optimal trade execution, one aims to devise a trading strategy that reaches a target position while minimizing the associated costs. This is often formulated as a stochastic control problem. We start with a stochastic control problem of a type that typically arises in the stream of literature on optimal trade execution pioneered by Obizhaeva and Wang. In such problems, the control process is of finite variation (possibly with jumps) and acts as integrator both in the state dynamics and in the cost functional. First, we continuously extend the problem from processes of finite variation to progressively measurable processes. Then, we reduce the extended problem to a linear quadratic (LQ) stochastic control problem. We solve the latter using results from the theory on LQ stochastic control. Finally, we recover the solution of the extended problem. Our framework allows for a stochastic target position and for a risk term with stochastic target process. Price impact and resilience are modeled by stochastic processes.

This is joint work with Thomas Kruse and Mikhail Urusov.

4.2 Discrete time mean-field stochastic optimal control problems: Pontryagin's Maximum principle, *Arzu Ahmadova, University of Duisburg-Essen*

In this paper, we study the optimal control of a discrete-time stochastic differential equation (SDE) of mean-field type, where the coefficients can depend on both a function of the law and the state of the process. We establish a new version of the maximum principle for discrete-time stochastic optimal control problems. Moreover, the cost functional is also of the mean-field type. This maximum principle differs from the classical principle since we introduce new discrete-time backward (matrix) stochastic equations. Based on the discrete-time backward stochastic equations where the adjoint equations turn out to be discrete backward SDEs with mean field, we obtain necessary first-order and sufficient optimality conditions for the stochastic discrete optimal control problem. To verify, we apply the result to production and consumption choice optimization problem.

4.3 Optimal Execution under Partially Observed States, *Burcu Aydogan, RWTH Aachen University*

We consider an optimal execution problem by maximizing the terminal wealth of the trader under partially observed states when permanent and temporary price impacts of the net-order flows exist. We first determine the processes which are observable and not observable which lead us an incomplete market information. Then, we solve the stochastic optimal control problem by writing and solving the corresponding Hamilton-Jacobi-Bellman (HJB) equation. Hence, we obtain the optimal policy of trading rate by finding the solution to the value function of the problem under partial information.

4.4 On correlated equilibria and mean field games in progressive strategies, *Ofelia Bonesini, University of Padova*

In Game Theory, Correlated Equilibria are a generalization of Nash Equilibria introduced to consider the possibility of a correlation between the strategies of the players. We study these equilibria in the context of N-player and mean-field games.
This work aims at extending the results in [Correlated Equilibria and Mean-Field Games: a simple model (2020); L. Campi, M. Fischer], relaxing the hypothesis that the strategies used by the players are restricted, i.e. they only depend on the state of the player himself. Instead, we consider more general deviations that also depend on the states of the other players through the empirical measure.
This generalization is highly non-trivial and introduces several technical difficulties in the problem.
Our first concern is to provide a good definition for the concept of Correlated solution in the mean-field context.
The consistency of this definition is then checked proving that a correlated solution for the MFG can be used to build ε_N-Correlated Equilibria for the N-player game, with an infinitesimal sequence ε_N.
Finally, we display an example of a two-state MFG possessing correlated solutions with non-deterministic flow of measures that satisfies all the assumptions.

4.5 The contact process with fitness on Galton-Watson trees, *Natalia Cardona Tobon, Georg-August-University Göttingen*

The contact process is a simple model for the spread of an infection in a structured population. We consider a variant of this process on Galton-Watson trees, where vertices are equipped with a random fitness representing inhomogeneities among individuals. In this talk, we establish conditions under which the contact process with fitness on Galton-Watson trees exhibits a phase transition. We prove that under certain mixing moments of the offspring and fitness the survival threshold is strictly positive. Further, we show that, another mixing moments assumption implies no phase transition and the process survives with positive probability for any choice of the infection parameter. A similar dichotomy is known for the contact process on a Galton-Watson tree. However, we see that the introduction of fitness means that we have to take into account the combined effect of fitness and offspring distribution to decide which scenario occurs. This is joint work with Marcel Ortgiese (University of Bath).

4.6 On the motion of motor proteins: A large deviation approach, *Serena Della Corte, TU Delft*

We consider the context of molecular motors modelled by a small noise diffusion. In this set- ting, the potential depends on a variable modelling a molecular switch. In the large time limit, we prove Large deviation principle of trajectories by the analysis of an associated Hamilton- Jacobi equation. Following the Jin Feng and Thomas Kurtz's method, we prove comparison principle for an equation in which the Hamiltonian is the principle eigenvalue of a cell problem, depending both on points and on momenta. We start analysing a particular model leading to a more general theorem. Moreover, we give the action-integral representation of the rate function.

4.7 Gaussian Fluctuations for the 2d directed polymers in the quasi-critical regime, *Francesca Cottini, Università degli Studi di Milano-Bicocca*

The model of directed polymer in random environment describes a perturbation of the simple random walk given by a random environment (disorder). The partition functions of this model have been throughly investigated in recent years, also motivated by their link with the solution of the Stochastic Heat Equation. In this talk we focus on the 2d case and we show that Gaussian fluctuations hold in the so-called quasi-critical regime, which interpolates between the sub-critical regime (where a deep understanding has by now been obtained) and the critical regime (where many key questions are still open). Our results identify the most extended regime where Gaussian fluctuations can hold, before reaching the critical regime where they fail.
This is a joint work with Francesco Caravenna and Maurizia Rossi (University of Milano-Bicocca).

4.8 Computational martingale optimal transport and mathematical finance, *Linn Engström, KTH Royal Institute of Technology*

The optimal mass transport problem is an intriguing problem that was first introduced by Gaspard Monge in the 18^{th} century. Computational advances has resulted in it attracting renewed attention in recent years since many problems can be viewed as an optimal mass transport problem. One such problem arises within robust mathematical finance: [1] showed that model independent pricing of path dependent options can be seen as an

optimal mass transport problem with martingale constraints - a martingale optimal transport problem.
In this talk we will propose a method for computationally addressing the martingale optimal transport problem. We will also provide computational solutions for a few special cases and make comparisons with analytical solutions when they are known.
This is ongoing joint work together with Johan Karlsson and Sigrid Källblad.

[1] Beiglböck, M. and Henry-Labordère, P. and Penkner, F. Model-independent bounds for option prices—a mass transport approach. *Finance Stoch*, 17:477-501, 2013.

4.9 One-dimensional mean-field problem for the advancing front of an epidemic, *Eliana Fausti, University of Oxford*

In this talk, I will introduce a simple one-dimensional mean-field model for the evolution of an epidemic. Each individual in a large population starts from some level of 'shielding', given by a number between zero and infinity, and this level then evolves over time according to diffusive dynamics driven by independent Brownian motions. If the level of shielding gets too low, individuals will find themselves in 'at-risk' situations, as captured by proximity to a lower moving boundary, called the epidemic front. Specifically, local time is accumulated at this boundary and infection may then occur at a rate depending on this as well as the intrinsic infectiousness and the current proportion of infected individuals. I will start by explaining how to rigorously construct such a particle system and then show how, under suitable conditions, the empirical measures will converge to a weak probabilistic formulation of a nonlinear moving boundary problem on the real line. Finally, I will discuss how one can prove uniqueness and establish sufficient regularity to ensure that the limiting mean-field problem yields a classical solution.

4.10 Nash equilibria for relative investors via no-arbitrage arguments, *Tamara Göll, Karlsruhe Institute of Technology (KIT)*

We analyze the optimal investment behavior of n agents trading in a general arbitrage-free financial market. The objective function of a single agent, previously used by Lacker and Zariphopoulou („Mean field and n-agent games for optimal investment under relative performance criteria", Mathematical Finance, 29(4):1003–1038, 2019), is given in terms of his own as well as the other $n-1$ agents' terminal wealth. In this context we determine Nash equilibria by solving an auxiliary classical portfolio optimization problem. Moreover we prove that the Nash equilibrium is unique if and only if the solution to the auxiliary problem is unique. In the end, we will compare the Nash equilibrium and the optimal solution for a single agent in a more specific setting.
This talk is based on joint work with Nicole Bäuerle https://arxiv.org/abs/2111.02310.

4.11 On population growth with catastrophes, *Branda Goncalves, LPTM, Pontoise, France*

We study a particular class of Piecewise Deterministic Markov processes (PDMP's) which are semi-stochastic catastrophe versions of deterministic population growth models. In between successive jumps, the process follows a flow describing deterministic population growth. Moreover, at random jump times, governed by state-dependent rates, the size of the population shrinks by a random amount of its current size, an event possibly leading to instantaneous local (or total) extinction. We discuss conditions under which such processes are recurrent (positive or null) or transient. Some information on the embedded jump chain of the PDMP is also required when dealing with the classification of states 0 and ∞ that we exhibit.

4.12 Multidimensional Wright-Fisher diffusion with epistatic selection, *Kseniia Khudiakova, Institute of Science and Technology Austria*

Convergence of the discrete Wright-Fisher model to the Wright-Fisher diffusion is a celebrated result in population genetics. I will first discuss the convergence for the multilocus case with epistatic selection and infinite recombination (Aurell et al., bioarxiv preprint: https://doi.org/10.48550/arXiv.1906.00716). The resulting diffusion limit is a system of SDEs coupled through the drift term. Then, I will present biological applications of this result. Namely it can be used to infer the speed of evolution, genetic diversity and fixation probabilities.

4.13 Simulating First Passage Times for Itô Diffusions, *Devika Khurana, Johannes Kepler University, Linz, Austria*

We are interested in the mechanism of olfactory receptor neuron responses in moth. A neuron's processing of information is represented by spike trains, collections of spikes, short and precisely shaped electrical impulses. Mathematically these can be modelled as First Passage Times of solutions of certain stochastic differential equations, describing the membrane voltage, to a threshold. Classical numerical methods like Euler Maruyama method, Milstein scheme, approximate hitting times as a 'by-product' and are not very good if we perform them on a large interval of time. For that reason, we study an algorithm which simulates the exact discretised grid of a class of Stochastic differential equations. It uses an acceptance-rejection scheme for the simulation of that grid at random time intervals, later the whole path can be completed independently of the target process by interpolation of Brownian Bridge or Bessel Bridge. This method is very effective in the sense that neither it simulates the whole path nor focuses on a fixed time interval. We further examine the different numerical methods with the help of an example.

4.14 On the gain of collaboration, *Maike Klein, Kiel University*

We consider two companies with endowment processes given by Brownian motions with drift. In the first model the firms can collaborate by transfer payments and hence, control the drift rates in order to maximize the probability that none of them goes bankrupt.
We derive the optimal strategy for the collaboration if the Brownian motions are correlated. Moreover, we state the minimal ruin probability in case of perfectly positively correlated Brownian motions and compute the gain of collaboration.
In the second model the firms can split up the risk by controlling the diffusion coefficients of the driving Brownian motions. The optimal strategy for maximizing the survival probability of both firms as well as the gain of collaboration are presented.
This talk is based on joint works with Peter Grandits (TU Wien), Stefan Ankirchner and Robert Hesse (both University of Jena).

4.15 Spectral methods for SPDEs with application, *Tijana Levajkovic, TU Wien*

This talk is devoted to spectral methods for solving linear and nonlinear stochastic partial differential equations with applications in optimal control. Particularly, the aim is to solve these equations using the polynomial chaos expansion (PCE) method, a spectral method based on the tensor product of deterministic orthogonal polynomials as a basis in the space of square integrable stochastic processes. We focus on stochastic evolution equations with Wick-type nonlinearities where the coefficients, initial and boundary conditions might be highly singular, i.e., they are generalized stochastic processes. The motivation comes from models arising in ecology, medicine, seismology, aerodynamics, structural acoustics and financial mathematics. Using the PCE method combined with operator theory, semigroup theory, and theory of deterministic partial differential equations, we prove that the stochastic evolution equations under consideration have unique solutions in appropriate (weighted) spaces of stochastic processes. The obtained solutions are given in explicit forms, which allows an efficient numerical approximation. In addition, we consider the related stochastic optimal control problem where the cost functional is quadratic. We provide a novel framework for solving these optimal control problems using the PCE approach. Numerical experiments show the performance of the proposed method.

4.16 Gelation in a Spatial Marcus-Lushnikov Process, *Elena Magnanini, WIAS Berlin*

A coagulation process describes the behavior of a particle system where families of particles merge (or coagulate, or coalesce) as time passes. The coagulation mechanism is regulated by a kernel, that is typically a positive symmetric function of the two masses (and not of the space). When it grows sufficiently fast, as the size of the particles gets large, infinite particles could emerge in finite time; this kind of phase transition is known as gelation. In the present talk we consider a spatial coagulation model, where the spatial interaction is driven by the kernel, and we describe conditions that guarantee gelation phase transitions. Under proper assumptions, coupling with the inhomogeneous random graph is also possible. Moreover, we prove that the spatial Marcus-Lushnikov process that registers the cluster dynamics of our spatial coalescent model, converges to a spatial Smoluchowski equation in the large mass limit.
Joint work with L. Andreis and T. Iyer.

4.17 Noise-induced periodicity in a frustrated network of interacting diffusions, *Elisa Marini, University of Padua*

We investigate the emergence of a collective periodic behavior in a frustrated network of interacting diffusions. Particles are divided into two communities depending on their mutual couplings. On the one hand, both intra-population interactions are positive: each particle wants to conform to the average position of the particles in its own community. On the other hand, inter-population interactions have different signs: the particles of one population want to conform to the average position of the particles of the other community, while the particles in the latter want to do the opposite. We show that this system features the phenomenon of noise-induced periodicity. In the macroscopic limit, in a certain range of interaction strengths, although the system has no periodic behavior in the zero-noise limit, a moderate amount of noise may generate an attractive periodic law.

4.18 Signature Methods in Stochastic Portfolio Theory, *Janka Möller, University of Vienna*

We introduce a novel class of functionally generated portfolios, which we call signature portfolios. In stochastic portfolio theory, the construction of portfolios via the relative market capitalizations μ is of great interest and to do so, one usually considers a portfolio generating function $\mathbf{S}(\mu)$ and constructs portfolios via $S^i(\mu) := D_i(\log(\mathbf{S}(\mu)))$ for $0 \leq i \leq d$ for a market of d stocks. We, however, do not require the $S^i(\mu)$ to be the log-gradient of a function and therefore, we refer to the $S^i(\mu)$ directly as portfolio generating functions. Moreover, we allow for the $S^i(\mu)$ to be path-functionals. For signature portfolios, the functions $S^i(\mu)$ are linear functions of the signature of the time-augmented relative market capitalizations. Signature portfolios are *universal* in the sense that every continuous (with respect to certain variation metrics) path-dependent portfolio generating function $S^i(\mu)$ can be uniformly approximated by a signature portfolio generating function. This approximation result is applicable to the log-optimal portfolio in a large class of non-Markovian markets, that is, the log-optimal portfolio's weights in those markets can be approximated arbitrarily well by signature portfolios. We study the optimization task of maximizing the expected log-relative-value of a signature portfolio and find that this leads to a *convex quadratic optimization problem*. We use these theoretical results to implement the learning task of maximizing the expected log-relative-value in simulated markets and we apply the optimization procedure to real market data.

4.19 Generalized Feynman-Kac Formula under volatility uncertainty, *Katharina Oberpriller, Albert Ludwigs University Freiburg*

In this paper we provide a generalization of the Feynman-Kac formula under volatility uncertainty to include an additional linear term due to discounting. The presence of the linear term in the PDE prevents the conditions under which a Feynman-Kac formula in the G-setting is provided in (Comparison theorem, Feynman-Kac formula and Girsanov transformation for BSDEs driven by G-Brownian motion, Stochastic Processes and their Application, 124 (2)), to hold. Up to our knowledge, there are no contributions in the literature where such a relation between G-conditional expectation and solutions of (nonlinear) PDEs is given in a setting not satisfying the hypothesis of (Comparison theorem, Feynman-Kac formula and Girsanov transformation for BSDEs driven by G-Brownian motion, Stochastic Processes and their Application, 124 (2)).
Here, we establish for the first time a relation between nonlinear PDEs and G-conditional expectation of a *discounted* payoff.
We introduce a family of fully nonlinear PDEs identified by a regularizing parameter with terminal condition φ at time $T > 0$, and obtain the G-conditional expectation of a discounted payoff as the limit of the solutions of such a family of PDEs when the regularity parameter goes to zero. This is a joint work with Bahar Akthari, Francesca Biagini and Andrea Mazzon.

4.20 Spatial modelling and inference with SPDE- based GMRFs, *Corinna Perchtold, Johannes Kepler University Linz/Institute of Stochastics*

Gaussian random fields (GRFs) are a type of geostatistical model used in a range of spatial inference problems. In many such contexts data are available at a given spatial scale (or multiple scales), whereas inference or predictions are required at another scale that represents a different spatial configuration. We are in particular interested in downscaling in the context of global to local climate models, where GRFs play an important role, as a small number of parameters can be used to express a wide range of spatial properties.
The GRF model of interest and the accompanying Bayesian inferential procedure use the INLA-SPDE approach. In this talk I will describe the GRF model, the inference procedure and simulation method and discuss challenges in this situation.

4.21 A branching particle system as a model of semi pushed fronts, *Julie Tourniaire, ISTA and University of Vienna*

We consider a system of particles performing a one-dimensional dyadic branching Brownian motion with space-dependent branching rate, negative drift $-\mu$ and killed upon reaching 0, starting with N particles. More precisely, particles branch at rate $\rho/2$ in the interval $[0,1]$, for some $\rho > 1$, and at rate $1/2$ in $(1,+\infty)$. The drift $\mu(\rho)$ is chosen in such a way that, heuristically, the system is critical in some sense: the number of particles stays roughly constant before it eventually dies out. This particle system can be seen as an analytically tractable model for fluctuating fronts, describing the internal mechanisms driving the invasion of a habitat by a cooperating population. Recent studies from Birzu, Hallatschek and Korolev suggest the existence of three classes of fluctuating fronts: pulled, semi-pushed and pushed fronts. Here, we rigorously verify and make precise this classification and focus on the semi-pushed regime. More precisely, we prove the existence of two critical values $1 < \rho_1 < \rho_2$ such that for all $\rho \in (\rho_1, \rho_2)$, there exists $\alpha(\rho) \in (1,2)$ such that the rescaled number of particles in the system converges to an α-stable continuous-state branching process on the time scale $N^{\alpha-1}$ as N goes to infinity. This complements previous results from Berestycki, Berestycki and Schweinsberg for the case $\rho = 1$.

4.22 Lower variance bounds for Poisson functionals, *Vanessa Trapp, Hamburg University of Technology*

Lower bounds for variances are often needed to derive central limit theorems. In this talk, we establish a specific lower bound for the variance of a Poisson functional that uses the difference operator of Malliavin calculus.

Poisson functionals, i.e. random variables that depend on a Poisson process, are widely used in stochastic geometry. In this talk, we show how to apply our lower variance bound to statistics of spatial random graphs, the L^p surface area of random polytopes and the volume of excursion sets of Poisson shot noise processes. This talk is based on joint work with M. Schulte.

4.23 Large deviation asymptotics of condition numbers of random matrices, *Denise Uwamariya, Linköping University*

Let $\mathbf{X}$ be a $p \times n$ random matrix whose entries are i.i.d. real random variables with zero mean and unit variance. In this paper we study the limiting behaviors of the 2-normal condition number $k(p,n)$ of $\mathbf{X}$ in terms of large deviations for large n (and possibly for large p at the same time as well). There are two main ingredients proposed in this paper: (i) the first one is to relate the distribution function of $k(p,n)$ to the one involving n i.i.d. random variables which enables us to consider quite general distribution of the entries (namely sub-gaussian distribution), and (ii) the second one is, for standard normal entries, to control the upper tail of $k(p,n)$ using the upper tails of ratios of two independent χ^2 distributions, which enables us to establish an application in statistical inference.

4.24 Quantitative Tracy–Widom laws for the largest eigenvalue of generalized Wigner matrices, *Yuanyuan Xu, IST Austria*

We show that the fluctuations of the largest eigenvalue of a generalized Wigner matrix of size N converge to the Tracy–Widom laws at a rate of nearly $O(N^{-1/3})$, as N tends to infinity. We allow the variances of matrix entries to be different but comparable. Our result improves the previous rate $O(N^{-2/9})$ obtained by P. Bourgade and the proof relies on a long-time Green function comparison theorem near the edges without any moment matching condition. This is joint work with K. Schnelli.

4.25 Effective dynamics of interfaces for nonlinear SPDEs driven by multiplicative white noise, *Shenglan Yuan, Universität Augsburg*

In the present work, we investigate the dynamics of the infinite-dimensional stochastic partial differential equations (SPDEs) with multiplicative white noise. We derive the effective equation on the approximate slow manifold detailedly by utilizing a finite-dimensional stochastic ordinary differential equation (SDE) describing the motion of interfaces. In particular, we verify the equivalence between the full SPDE and the coupled system under small stochastic perturbation. We use sophisticated large deviations to analyze the stochastic stability and show that solutions stay close to the slow manifold for a very long time with high probability via asymptotic estimates on the exit time. Moreover, we apply our results to modulation and amplitude equations, illustrated with an example about dynamical stability of stochastic Korteweg–de Vries equation. This is a joint work with Dirk Blömker.

4.26 Ergodic results for the stochastic nonlinear Schroedinger equation, *Margherita Zanella, Politecnico di Milano)*

We study the nonlinear stochastic Schrödinger equation with linear damping. We prove the existence of invariant measures in the case of two dimensional compact Riemannian manifolds without boundary and compact smooth domains of $\mathbb{R}^2$ with either Dirichlet or Neumann boundary conditions. We prove the uniqueness of the invariant measure in $\mathbb{R}^d$, $d = 2,3$ when the damping coefficient is sufficiently large. The talk is based on joint works with B. Ferrario and Z. Brzeźniak.

4.27 Stochastic Heat Equation with piecewise constants coefficients, *Eya Zougar, Faculty of science, Monastir, Tunisie*

This talk is devoted to stochastic partial differential equation SPDE having piecewise diffusion coefficient, with two points of discontinuity, driven by additive Gaussian noise that behaves as a Wiener process in space and the time covariance measure generates a signed measure. Firstly, we compute the covariance function of the mild solution and we give the necessary and sufficient condition for it existence. Then, we limit our work on the SPDE driven by Generalized fractional Brownian motion. We survey some characteristics of it solution and we analyze the various paths properties of it with respect to time variable.