Workshop timetable

	Monday 19th July	Tuesday 20th July	Wednesday 21st July	Thursday 22nd July	Friday 23rd July
09.00-10.30		**Trickle-down growth models,...** (Evans)	**Trickle-down growth models,...** (Evans)	**Regularity and convergence of diffusion processes** (Hairer)	**Regularity and convergence of diffusion processes** (Hairer)
10.30-11.00		Coffee			
11.00-12.30		**Regularity and convergence of diffusion processes** (Hairer)	**Regularity and convergence of diffusion processes** (Hairer)	**Trickle-down growth models,...** (Evans)	**Trickle-down growth models,...** (Evans)
12.30-14.00	**Registration and lunch**	Lunch			End of workshop
14.00-15.30	**Trickle-down growth models,...** (Evans)	**Problem Session**	**Participant talks** (until 15.00) Coffee (15.00-15.30)	**Problem session**	
15.30-16.00	Coffee		**Scaling exponents for directed polymers** (Seppäläinen) (until 16.30)	Coffee	
16.00-17.30	**Regularity and convergence of diffusion processes** (Hairer)	**Participant talks**		**Participant talks**	
Evening	Dinner	Garden Party	Dinner	Conference dinner	

Further information

Trickle-down growth models, Doob-Martin boundaries, and random matrices

Prof. Steve Evans

University of California, Berkeley

Several Markov chains appearing in applied probability (for example, the random binary search tree and recursive random tree processes) may be viewed as growing connected subsets of a graph that evolve according to the following general dynamics: initially, all vertices of the graph are unoccupied, particles are fed in one-by-one at a distinguished source vertex, successive particles proceed along directed edges according to an appropriate stochastic mechanism, and each particle comes to rest once it encounters an unoccupied vertex. I will explain how classical tools from Doob-Martin boundary theory may be used to understand the large time asymptotics of such processes. Along the way, we will encounter objects such as Pólya urns, Dirichlet random measures, Pitman's generalization of the Ewens sampling formula, and Chinese restaurant processes. If time permits, I will also discuss tools for understanding the asymptotics of the spectra of various random matrices associated with these models.

Regularity and convergence of diffusion processes

Prof. Martin Hairer

University of Warwick

The aim of these lectures will be to provide a number of tools that allow one to determine at which speed (if at all) the law of a diffusion process approaches its stationary distribution. Of particular interest will be cases where this speed is subexponential. At the technical level, the first part of the course will be devoted to an elementary introduction to Malliavin calculus and to a proof of Hörmander's famous "sums of squares" regularity theorem. The second part will be devoted to Lyapunov function techniques, placing emphasis not only on abstract results, but also on techniques of how to construct such functions in practice. Throughout the whole course, an "Ariadne's thread" will be provided by a few apparently simple toy models from statistical mechanics that nevertheless exhibit a surprisingly rich palette of possible behaviours.

The workshop will also feature a one-off talk:

Scaling exponents for $1+1$-dimensional directed polymers

Prof. Timo Seppäläinen

University of Wisconsin-Madison

In $1 + 1$ dimensions directed polymers are expected to behave superdiffusively: the order of magnitude of the fluctuations of the polymer path is described by the exponent $2/3$, in contrast with the exponent $1/2$ of diffusive paths such as standard random walk and Brownian motion. Recently this exact value of the fluctuation exponent has been proved for two particular polymer models, a discrete model with log-gamma distributed weights and a model with a Brownian random environment. In addition, these models have a particular boundary condition which in a sense corresponds to a stationary initial state. This talk describes the model with log-gamma weights and the ideas that lead to the results, including a Burke property that gets its name from an analogy with a well-known result from queueing theory.

Social events

Monday Evening

Everyone who registered for the workshop is welcome to attend dinner at 18.30-20.30 on Monday. Further details will be provided on the day.

Tuesday Evening

Prof. Wilfrid Kendall and his wife Catherine have been extremely generous in inviting all the participants of the P@W workshop to a garden party at their house (so thank you very much to them!). Further details will be provided on the day.

Wednesday Evening

Dinner on campus at 18.30-19.30, only for those who registered with accommodation.

Thursday Evening

The conference dinner will take place in the Chancellors Suite, in the Rootes Social Building at 19.30. Please meet at Rootes Reception at 19.15.

Participant talks: session 1

Tuesday 20th July, 16.00-17.30

Rough paths: Introduction and discrete approximation

Rafael Andretto Castrequini

University of Campinas

I will introduce the ideas of rough path integration. Afterwards, I will show a link between Gubinelli's sewing map and Davie's discrete approximation to rough differential equations. This link was developed on my master thesis.

Martingales associated with killed fragmentation processes

Robert Knobloch

University of Bath

We introduce homogenous fragmentation processes whose blocks are killed when being sufficiently small. In this context we consider the probability of extinction of this process as a function of the initial value of the fragmentation and derive certain properties of that function. Our main results are concerned with associated additive and multiplicative martingales. The approach is based on defining killed spectrally negative Lévy processes by resorting to intrinsic subordinators. Our motivation for considering the aforementioned killed fragmentation processes stems from their connection with FKPP travelling waves in the setting of fragmentations.

Generalised particle filters

Kai Li

Imperial College London

The process of using partial observations and a stochastic model to make inferences about an evolving system is known as stochastic filtering. Particle filters are Monte-Carlo type methods for approximating the solutions of the stochastic filtering problem. Current particle filters approximate the solutions by a sum of Dirac measures. In this talk, I consider a more general framework known as generalised particle filters. In this case each generalised particle consists of a triple parameter and is characterised by Gaussian measures. I will discuss the construction of the approximating particle system, and prove the first order convergence result. This is joint work with Dr. Dan Crisan.

Site and bond percolation on random geometric graphs

Thomas Rosoman

University of Bath

I will outline a proof that the critical site probability is strictly greater than the critical bond probability on Gilbert's graph and discuss how this can be generalised to other random geometric graphs.

Participant talks: session 2

Wednesday 21st July, 14.00-15.00

Convergence toward two Gaussian processes from a unique Poisson process

David Bascompte

Autonomous University of Barcelona

We present a general result of weak convergence, in the sense of the finite dimensional distributions, toward two integrals of $L^2(\mathbb{R}^+)$ functions with respect to two independent standard Brownian motions, where the approximating processes are constructed from a single Poisson process. As an application of this result, we present a weak approximation of the sub-fractional Brownian motion with parameter $H \in (0,1)$, which can be decomposed into the sum of a fractional Brownian motion plus a stochastic process with absolutely continuous trajectories introduced by Lei and Nualart (A decomposition of the bifractional Brownian motion and some applications, *Statist. Probab. Lett.*, **79**:5 (2009) 619–624). In order to apply the theorem to sub-fractional Brownian motion we first prove weak convergence toward fractional Brownian motion and toward the process introduced in Lei and Nualart. This is joint work with Xavier Bardina.

Generalization of Bose-Einstein Statistic and possible fields of application

Tomasz Lapinski

University of Warwick

Statistical Mechanics equip us with various tools for the description of complex microscopic system, like gases, atoms, liquids etc. By introducing several idealised assumptions together with probability theory and classical or quantum mechanics, to some extent, we are able to predict the behaviour of such system. We consider Bose-Einstein (BE) Statistics which is a particular model of Statistical Mechanics. Literally, it describes distribution of identical indistinguishable particles (bosons) over the possible energy states in atom in thermal equilibrium. However, this model was developed purely for physical application. In case of slight relaxation of model assumptions we obtain three different statistics, where BE is a particular case. The two other statistics might be applied to fields like linguistics, finance or economy. In my talk, I will introduce you theses three statistics and give flavour of application with some examples.

Universality properties of Gelfand-Tsetlin patterns

Anthony Metcalfe

University of Paris VI

Probability measures on sets of interlaced particles arise naturally in the study of random matrices. Perhaps the best studied example of such distributions is the eigenvalues of the minors of the Gaussian unitary ensemble. The asymptotic behaviour of the eigenvalues is of particular interest. Properly rescaled, the eigenvalues of the minors behave asymptotically like a determinantal random point field with the Sine kernel. In this talk I would like to give an introduction to the known results of this field, and briefly discuss a related model on which I have been working: The universal asymptotic behaviour of particles in random Gelfand-Tsetlin patterns.

Participant talks: session 3

Thursday 22nd July, 16.00-17.30

Stochastic delay equations with non-negativity constraints driven by fractional Brownian motion

Mireia Besalú

University of Barcelona

We consider a multidimensional stochastic delay equation with reflection and with an hereditary drift driven by fractional Brownian motion with Hurst parameter $H > 1/2$. For this equation we prove an existence and uniqueness result of solution. We follow the methodology introduced in Nualart and Rascanu (Differential equations driven by fractional Brownian motion, *Collect. Math.* **53** (2002) 55-81). The stochastic integral with respect to the fractional Brownian motion is a pathwise Riemann-Stieltjes integral. This is a joint work with Carles Rovira.

On the convergence of operator semigroup

Rui Xin Lee

University of Warwick

Operator semigroup provides an important tool in the study of Markov Processes. In this talk, we discuss the approximation and convergence results, which are used as the basis of approximation and convergence theorems of Markov Processes. We present its application in constructing Markov chains to approximate (Feller)-diffusion and Lévy processes, and then establish their rates of convergence. This is particularly useful in approximating barrier options (Feller) price process with Markov chains as the expected values of the discretely monitored Arrow-Debreu securities can be shown converging to the continuous monitored securities.

Representations and functionals of the free Brownian bridge

Janosch Ortmann

University of Warwick

In non-commutative probability the free Brownian motion can be considered as the limit of Brownian motion on N-dimensional Hermitian matrices as the dimension tends to infinity. We consider two representations of a related process, the free Brownian bridge, as infinite sums of semicircular random variables. These representations are used to describe some functionals of the free Brownian bridge. The second component of the signature of a Banach-valued path X, an object of interest in rough path theory, is given by the integral of X against itself. It was shown by Capitaine and Donati-Martin that this is well-defined if X is a free Brownian bridge. We calculate the R-transform, the non-commutative analogue of the Fourier transform of this object and of the Lévy area of the free Brownian bridge. Furthermore we study the L^2-norm of the free Brownian bridge and again give the R-transform. The R-transform determines the distribution of a free random variable and we deduce some properties of the distributions considered.

Multi-type TASEP in discrete time

Philipp Schmidt

University of Oxford

The TASEP is a simple model for an interacting particle system on $\mathbb{Z}$. We will introduce the TASEP in continuous and in discrete time with various update rules and show connections to other models like last-passage percolation and growth models. The TASEP can be extended to a multi-type model. We will present some of the questions connected to this model and mention some of the results.