Anja Sturm (Universität Göttingen)

On particle systems with cooperative branching and coalescence

In this talk we consider a one-dimensional model of particles performing independent random walks, where only pairs of particles can produce offspring (cooperative branching) and particles that land on an occupied site merge with the particle present on that site (coalescence). We show that the system undergoes a phase transition as the branching rate is increased. For small branching rates the upper invariant law is trivial and the process started with finitely many particles a.s. ends up with a single particle. Both statements are not true for high branching rates. We also show that if the branching rate is small enough then the particle density of the process started in the fully occupied state decays as one over the square root of time, and that the same is true for the decay of the probability that the process still has more than one particle at a later time if started with two particles.

Kathrin GLAU (Technische Universität München)

Weak solutions of the Kolmogorov backward equations for option pricing in Lévy models

One major task mathematical finance sets itself is modeling, pricing and calibration of financial instruments. (Semi)martingale theory is used for modeling and derivative prices are written as conditional expectations. Typically, the latter are not available in closed form and, thus, computational methods become necessary. Essentially three approaches to compute the expectations are being used: Monte Carlo simulation, Fourier based valuation methods and the representation of prices as solutions of partial integro-differential equations (PIDEs). In this context we focus on Galerkin methods for solving PIDEs arising in Lévy models. We classify Lévy processes according to the solution spaces of the associated parabolic PIDEs and give a relation to the Blumenthal-Getoor index. Furthermore, we derive Feynman-Kac representations of variational solutions. We discuss applications to option pricing and give an outlook on a calibration procedure.

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Bénédicte HAAS (Université Paris-Dauphine)

Scaling limits of large random trees

Large scale behavior of random trees has been the object of an intense research for both combinatorists and probabilists for a few decades. Initially the research focused on certain statistics of the trees: height of a typical vertex, maximal height, diameter, etc. A turning point came in the early 90s with the pioneering work of Aldous on the

Brownian continuum random tree (CRT): Aldous proved that a critical Galton-Watson tree with a finite variance offspring distribution, seen as a metric space and properly rescaled, converges towards the CRT. Actually, as for random walks, there is an invariance principle: many classes of random trees are known to converge after rescaling towards the CRT. However other limits are also possible, among which two important classes of continuous trees: the stables Lévy trees introduced by Duquesne, Le Gall and Le Jan (which are the scaling limits of critical Galton-Watson trees with an offspring distribution in the domain of attraction of a stable law) and the fragmentation trees (which are the scaling limits of the so-called Markov branching trees).
In this talk we will first review classical results on scaling limits of random trees, in particular those of Aldous and Duquesne on scaling limits of Galton-Watson trees. We will then turn to the scaling limits of Markov branching trees, which is the content of a work done jointly with Grégory Miermont. Several applications will be discussed.

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Sabine JANSEN (Ruhr-Universität-Bochum)

Metastability at low temperature for continuum interacting particle systems

We consider a system of point particles in a finite box in $\mathbf{R}^2$ that interact via a finite-range attractive pair potential, and move according to a Markov process that has the grand-canonical Gibbs measure as a reversible measure. The chemical potential is such that the system favors a packed box, but has a nucleation barrier to overcome in order to go from an empty box to a filled box. We are interested in the nucleation time in the limit as the temperature tends to zero. We use the potential-theoretic approach to metastability. The results should extend earlier work for lattice systems; the main difficulty lies in understanding the energy landscape of the continuum particle system, a problem of intrinsic interest in analysis. This talk reports on joint work in progress with Frank den Hollander.

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