ROBERT J. ADLER
Technion - Israel Institute of Technology

THE BURGERS SUPERPROCESS

The (density of the) one-dimensional Burgers superprocess is defined as the solution of the non-linear stochastic partial differential equation

$$\frac{\partial}{\partial t}u(t,x) = \Delta u(t,x) \ - \ \lambda u(t,x)\nabla u(t,x) \ + \ \gamma\sqrt{u(t,x)}\ W(dt,dx).$$

where W is space time white noise. The aim of the talk will be to explain

1: Why this equation is interesting.

2: That it has at least one solution that is a real-valued, continuous, stochastic process on $\Re_+ \times \Re$.

3: Discuss the proof of the result, which is based on discretization.

4: Discuss a related equation, related to "super goats".

5: Discuss (unsolved) issues of uniqueness, both strong and in law.

Item 4 is joint work with Ekaterina Todorova, and Item 5 with Roger Tribe. The rest is joint with Guillaume Bonnet.

RICK DURRETT
Cornell University

Biodiversity

How many species can coexist in a universe consisting of N sites? Is this number increased or decreased if dispersal is local rather than global? We will present some answers and some conjectures.

LUIS G. GOROSTIZA ORTEGA
Centro de Investigación y de Estudios Avanzados

Trajectorial fluctuations of particle systems,
time-localization and self-intersection local time

We present results on trajectorial fluctuation limits of particle systems in $\Re^d$, which take values in a space of distributions on Wiener space, temporal versions of such results obtained by a time-localization method, and existence of self-intersection local time for Gaussian processes with values in the space of tempered distributions on $\Re^d$. Examples include Cox systems of particles and fractional Brownian density processes.

ANDREAS GREVEN
Friedrich Alexander-Universität - Erlangen

Longtime behavior of interacting stochastic systems

We discuss spatial stochastic models for populations involving individuals of different type. Compared with the one type situation this gives rise to new phenomena and requires new mathematical methods. We focus on typical longtime behavior and the question how the behavior of large finite and infinite systems relates. The talks is based on joint work with T. Cox and D. Dawson.

THOMAS G. KURTZ
University of Wisconsin - Madison

A Brownian particle system with local time interaction and its corresponding SPDE (with Kevin Buhr)

An infinite collection of one-dimensional Brownian particles is considered. Each particle has a "type" and a (positive) "level". The level of a particle is fixed, but its type evolves as a Markov process between times of interaction with the other particles. The interaction times of two particles are determined by a Poisson process run with a clock that is proportional to the interaction local time of the two processes. At the jump times of this time-changed Poisson process, the type of the particle with the higher level changes to the type of the particle with the lower level.

With appropriate initial conditions, at each time t, the point process consisting of the location, type, and level of all particles is conditionally Poisson with a conditional mean measure that is the product of a random measure $K(t)$ on locations and types cross Lebesgue measure on levels. In particular cases, the random measure satisfies a stochastic partial differential equation that has been obtained by Mueller and Tribe (Probab. Theory Relat. Fields 102 (1995), 519-545) as the limit of long-range voter models. In the current setting, this limit can be reformulated in terms of convergence of corresponding particle models. The processes can also be obtained as limits of appropriately scaled stepping stone models.

Models in which the particle interaction is instantaneous rather that local-time based have been considered by Donnelly, Evans, Fleischmann, Kurtz and Zhou (Ann. Probab, to appear).

TERRY LYONS
Oxford University

Stochastic Differential Equations driven by Infinite Dimensional Brownian Motion

It may come as a surprise that until recently, little has been known about the Stratonovich differential equation

$$dy_t = f(y_t)dx_t \tag{1}$$

where x_t is Brownian motion on some Banach Space E and f is a bounded linear map from $E \to C^{2+\varepsilon}$ vector fields on some Banach manifold M. Simple questions still remain open. For example it is not known whether the bounded linear equations always have solutions! By studying the Levy Area process for x_t and its relationship with various tensor norms, and by exploiting the theory of Rough Paths we establish good sufficient conditions showing one can indeed solve such equations.

One corrollary is that in the case where M is a finite dimensional manifold solutions always exist and are unique.

This is joint work with Michele Ledoux and Zhongmin Qian

LEONID MYTNIK
Technion - Israel Institute of Technology

SPDE driven by stable noise

We prove the existence of a weak solution to the stochastic partial differential equation

$$\frac{\partial Y}{\partial t} = \frac{1}{2}\Delta Y + Y^{\beta}\dot{L}$$

driven by an asymmetric stable noise L on $R_+ \times R^d$ whose exponent α is greater than 1. The method is based on construction of a sequence of processes such that each limit point satisfies the martingale problem corresponding to the above SPDE. The construction is possible for parameters α, β satisfying $\alpha\beta < 1 + 2/d, \alpha < \min\{2, 1 + 2/d\}$. This work is motivated by the proof of uniqueness for an SPDE driven by white noise.

GEORGE PAPANICOLAOU
Stanford University

Imaging and time-reversal in random media

I will discuss how imaging is degraded by random inhomogeneities and how it is enhanced by time reversal. I will discuss the theoretical basis of this and several applications.

EDWIN PERKINS
University of British Columbia

Super-chains with interactive branching and degenerate sde's

We will survey some of the ideas used to introduce interactions into measure-valued branching diffusions and then describe some ongoing work with Siva Athreya, Martin Barlow and Rich Bass on state dependent branching for super-Markov chains. The main result is uniqueness in law for a class of degenerate diffusions.

GORDON SLADE
University of British Columbia

Critical oriented percolation in high dimensions

Super-Brownian motion has been shown to arise as the scaling limit for a number of models in statistical mechanics and interacting particle systems, above the upper critical dimension. This lecture will describe recent joint work with Takashi Hara and Remco van der Hofstad proving that the connectivity functions for critical spread-out oriented percolation above four spatial dimensions converge to those of super-Brownian motion.

S.R.S. VARADHAN
Courant Institute of Mathematics- NYU

Regularity of the Self Diffusion Coefficient

It was proved by Kipnis and Varadhan in mid eighties that a tagged particle in a symmetric simple exclusion process in equilibrium at density ρ will diffuse and converge after rescaling to a Brownian Motion with dispersion $S(\rho)$. Except for the one dimensional nearest neighbor case $S(\rho)$ is strictly positive definite for $\rho < 1$ and approaches 0 as $\rho \to 1$. In 1994, Varadhan showed that if $d \geq 3$ $S(\rho)$ satisfies a Lipschitz condition in ρ. It is shown now (with Stefano Olla and Claudio Landim) that $S(\rho)$ is in fact C^∞ in ρ in the closed interval $[0, 1]$ in all dimensions.

ANTON WAKOLBINGER
Johann Wolfgang Goethe - Universität - Frankfurt am Main

Random-constant limit intensities: two examples

We discuss two examples of systems in which the limiting intensity is spatially constant but random.

Consider an array of colonies of individuals of two genetic types, whose relative frequencies evolve by migration and by genetic drift (modelled by Fisher-Wright diffusions). We focus on a 2-dimensional situation in which the genetic drift is randomly turned on and off according to a voter model process. The well-known diffusive clustering then alternates with pure migration, and we find that the frequencies in the colonies converge to a common random constant, whose distribution we can characterize through a multiple scale analysis. This is joint with A. Greven and A. Klenke.

An analogous phenomenon occurs in branching systems with long living particles at the critical dimension (work in progress with K. Fleischmann and V. Vatutin): the big clumps caused by the branching find a time long enough to disperse, but in the long time limit a random intensity is built up which is constant over space.