Probability

(Org: **M.-E. Caballero** (UNAM), **V. Pérez-Abreu** (UAM-Cuajimalpa) and **T. Salisbury** (York))

MICHELLE BOUÉ, Trent University, 1600 West Bank Drive, Peterborough, Ontario K9J 7B8, Canada

Critical values for an epidemic model with moving particles

Kesten and Sidoravicius have recently introduced a spatial model for the spread of epidemics that takes into account the movement of individuals. We will discuss the phase transitions of this model and of some extensions that incorporate immunization and traps.

MARÍA-EMILIA CABALLERO, Universidad Nacional Autónoma de México, Instituto de Matemáticas, Circuito Exterior, Ciudad Universitaria, 04510 D.F. México

Conditioned stable Lévy processes and the ruin problem

In order to construct several interesting examples of Lévy processes, we work with the Lamperti transformation between Lévy processes and postive self-similar Markov processes.

By killing a stable Lévy process when it enters the positive half line, or by conditioning it to stay positive, or by conditioning it to hit 0 continuously, we obtain different positive self-similar Markov processes. We compute the infinitesimal generator of each of them and we also obtain, using the Lamperti's transformation, the corresponding Lévy processes and the characteristics of them.

As an application we obtain explicitly the law of the minimum before and independent exponential time, for some of these Lévy processes. This provides the explicit form of the spatial Wiener–Hofp factorization at a particular point and the value or the ruin probability for these processes.

This is based on a joint paper (to appear) with Loic Chaumont.

DONALD DAWSON, Carleton University

Catalytic branching processes

A catalytic branching diffusion processes is a continuous state branching process in which the branching rate depends on the presence of a catalyst. A catalytic branching network corresponds to a multitype system in which some types serve as catalysts for other types. Catalytic branching networks in which there are closed cycles of catalytic types, perturbations of these, and catalytic systems distributed in space pose a number of challenging mathematical problems. In this lecture we discuss some aspects of these problems from the viewpoint of the hierarchical mean-field limit.

LUIS GOROSTIZA, CINVESTAV, Departamento de Matemáticas, Av. IPN No. 2508, San Pedro Zacatenco, 07300 México D.F.

Some questions on occupation times of branching systems

We consider occupation time fluctuations of (d, α, β)-branching systems. The long time rescaling limit processes have different properties in intermediate, critical and large dimensions (*e.g.*, long-range dependence vs. independent increments, path continuity vs. jumps), and questions arise on interpretation of results in terms of the systems.

DANIEL HERNÁNDEZ-HERNÁNDEZ, Centro de Investigación en Matemáticas
Pricing, hedging and PDE's

In this talk we consider the mean-variance hedging problem when the market is incomplete. More specifically, we consider a stochastic volatility model, and study the problem using dynamic programming techniques. The nonlinear PDE involved in the solution is a parabolic quasi-linear equation with quadratic growth. Existence and uniqueness of classical solutions within a suitable class of smooth functions is obtained as well as relations with backward stochastic differential equations. Using these results an optimal hedging strategy is derived.

GAIL IVANOFF, University of Ottawa, Ottawa, ON, K1N 6N5, Canada
Filtering of set-indexed stochastic processes

Multiparameter and set-indexed stochastic processes have many important applications in the natural sciences and engineering. The concept of stopping, which plays a fundamental role for processes indexed by the real line, is less well understood in this more general framework. We introduce the concept of adapted filtering as an appropriate generalization of stopping. Applications in areas such as multivariate survival analysis and multivariate precedence tests will be discussed.

J. ALFREDO LÓPEZ-MIMBELA, Department of Probability and Statistics, CIMAT, Apartado Postal 402, 36000 Guanajuato, México
Symmetric steady states of a semilinear equation with fractional Laplacian

We study a semilinear PDE equation whose evolution operator is the sum of a fractional power of the Laplacian and a convex non-linearity. By extending the method of moving planes to fractional powers of the Laplacian we prove that all positive steady states of the corresponding equation in a finite ball are radially symmetric.

ANA MEDA, Facultad de Ciencias, UNAM
Estimates for the Value at Risk and ruin probabilities of diffusion processes with jumps

We have estimates for the tail distribution of $X_t^* = \sup_{0\le s\le t} X_s$, where X_s is a diffusion process with jumps which satisfies $X_s = m + \int_0^s \sigma_u\, dB_u + \int_0^s b_u\, du + \int_0^s \gamma_{u^-}\, d\tilde{N}_u$, where B is a Brownian motion; $\tilde{N}$ a compound Poisson process independent of B; b is an adapted integrable process; σ and γ are only assumed to be predictable—hence random, which encompasses all the stochastic volatility models. We discuss some applications to the estimation of a Dynamic Value at Risk and to the Ruin Probability of a risk process with stochastic investment.

VICTOR PÉREZ-ABREU, Universidad Autónoma Metropolitana Cuajimalpa
Representation of Infinitely Divisible Distributions on Cones

In this talk we present a probabilistic characterization of cones in Fréchet spaces. Specifically, we show that a normal cone K in a Fréchet space is regular if and only if every infinitely divisible probability measure concentrated on K has the regular Lévy–Khintchine representation on cone.

This is joint work with Jan Rosinski.

EDWIN PERKINS, Math. Dept., UBC, Vancouver, BC, V6T 1V2, Canada
Pathwise uniqueness for parabolic stochastic PDE's

Consider the SPDE: $du/dt = u" + g(u)dW/dtdx$ where $dW/dtdx$ is space-time white noise and g is Holder continuous of index h. It is shown that if $2h^3 - h > 3/4$ then pathwise uniqueness holds. The proof is an infinite dimensional extension of the Yamada–Watanabe Theorem.

This work is joint with Leonid Mytnik.

BRUNO RÉMILLARD, HEC Montreal

On signed-measure solutions of stochastic differential equations

We study existence and uniqueness of signed-measure solutions of a class of stochastic differential equations with respect to Wiener sheet, including as particular cases the two-dimensional Navier–Stokes equations in vorticity forms introduced by Kotelenez.

This is a joint work with Jean Vaillancourt.

VICTOR RIVERO, Centro de Investigación en Matemáticas (CIMAT), Calle Jalisco s/n Col. Valenciana, CP 36240 Guanajuato, Guanajuato

Recurrent extensions of positive self-similar Markov processes and Cramer's condition

Let $(X, \mathbb{P})$ be a positive self-similar Markov process that dies at its first hitting time of 0. In this work we study the existence and characterization of all positive valued self-similar Markov processes, $\widetilde{X}$, that behave like $(X, \mathbb{P})$ before its first hitting time of 0 and for which the state 0 is a regular and recurrent state. A such process $\widetilde{X}$ is called a recurrent extension of $(X, \mathbb{P})$. Our main result establishes that $(X, \mathbb{P})$ admits a self-similar recurrent extension that leaves 0 continuously if and only if the underlying Lévy process satisfies Cramer's condition.

ELIANE RODRIGUES, Instituto de Matemáticas, Universidad Nacional Autónoma de México, Area de la Investigación Científica, Circuito exterior, Ciudad Universitaria, México, DF 04510, México

A non-homogeneous Poisson model to estimate the number of ozone peaks in Mexico City

In this talk we consider the problem of estimating the number of exceedances of an air quality standard in a given period of time. A non-homogeneous Poisson model is proposed to analyse this issue. The rate at which the Poisson events occur is given by a rate function $\lambda(t)$, $t \geq 0$. This rate function also depends on some parameters that need to be estimated. Two forms for $\lambda(t)$, $t \geq 0$ are considered: Weibull and exponential-Weibull with parameters $\alpha \geq 0$, $\beta \geq 0$ and $\sigma \geq 0$, that will be estimated using a Bayesian formulation as well as a Gibbs sampling algorithm. The model is applied to the ozone data provided by the Mexico City monitoring network.

This is part of a joint work with Jorge A. Achcar from the University of São Paulo, Brazil, and A. A. Fernández-Bremauntz and G. Tzintzun both from the National Institute of Ecology of the Ministry of Environment, México.

BYRON SCHMULAND, University of Alberta, Edmonton, Alberta, Canada

Some recurrence sequences

We consider some generalizations of the renewal theorem for Markov chains. We will discuss both analytic and probabilistic approaches to finding the asymptotic behaviour of the solution of a renewal equation.

BÁLINT VIRÁG, University of Toronto

Scaling limits of random matrices

The sine and Airy point processes arising from random matrix eigenvalues play a fundamental role in probability theory, partly due to their connection to Riemann zeta zeros and random permutations.

I will describe recent work on the Stochastic Airy and Stochastic sine differential equations, which are shown to describe these point processes and can be thought of as scaling limits of random matrices. This new approach resolves some open problems, *e.g.* it generalizes these point processes for all values of the parameter beta.

JOHN WALSH, University of British Columbia, Vancouver, BC
The Rate of Convergence of Numberical Solutions of SPDEs

Numerical solutions of stochastic differential equations are more often used to simulate the solutions than to find them, so the rate of convergence in distribution of numerical solutions is especially interesting. We will talk about the rates of convergence, both almost sure and in distribution, of various schemes, with emphasis on the stochastic wave equation.