Omar Abuzzahab (Penn)
A Random Linear Space Process

Let X_1, X_2, X_3 … be an iid sequence of vectors chosen uniformly from a subset U of F_2^n and let V_1, V_2, V_3 … with V_t = < X_1, X_2, … , X_t > be the corresponding sequence of linear spans. A couple of natural questions are: when does the first linear dependence among the X_i's occur (i.e, when is dim V_t < t and how long until V_t = F_2^n When U is taken to be the whole space F_2^n and n is made large the first event occurs when dim V_t is nearly n, but when U is a proper subset things can be very different. I will present my research in the model where U is the set of all vectors with a fixed Hamming weight k. This model generalizes some familiar problems: when k=1 the first question is the Birthday Problem, the second is the Coupon Collector Problem, and when k=2 the first question relates to the appearance of the first cycle in a random graph.

Sergio Almada (Georgia Tech)
Small Noise Analysis of Non-Smooth stochastic Calculus.

When analyzing small noise SDE's from a dynamical systems point of view, non-smooth change of variables become of importance. We outline the importance of such a method while linearizing equations and is consequences. We show how the generalized Ito's formula by Follmer, Protter, Eisenbaum among others allow us to define a different kind of stochastic integration. While studying the properties of this integral, a non-adapted Ito term shows off, it turns out, using filtration expansion techniques, that the small noise analysis can be carried out once a heat kernel estimate is available for the gradient of the solution to a Fokker Plank equation. In this talk, I will specify the connections among this variate subjects and give a list of results that generalize the Friedlin-Wentzell LDP.

Daniela Bertacchi (Milan)
Critical parameters of the branching random walk and truncation

Given a branching random walk on a graph, we consider two kinds of truncations: either by inhibiting the reproduction outside a subset of vertices or by allowing at most m particles per vertex. We investigate the convergence of weak and strong critical parameters of these truncated branching random walks to the analogous parameters of the original branching random walk.

Giacomo Di Gesù (Bonn)
Spectral asymptotics of a Witten Laplacian on the lattice graph

A discrete analogue of the Witten Laplacian on the n-dimensional integer lattice is considered. After suitable rescaling of the operator and lattice size we provide sharp asymptotics of the low-lying spectrum on the level of 0-forms. Our proof, inspired by work of Helffer-Klein-Nier, is based on supersymmetric considerations and extensions to discrete setting of semiclassical techniques, as WKB expansions and Agmon-type estimates. The result can be reformulated in terms of some metastable Markov processes. These naturally arise in Statistical mechanics in the context of disordered mean field models, like the Random field Curie-Weiss model.

Lee Gibson (Louisville)
The rate of decay of the Wiener sausage in local Dirichlet space.

In the context of a heat kernel diffusion which admits a Gaussian type estimate with parameter β on a

local Dirichlet space, we consider the log asymptotic behavior of the negative exponential moments of the Wiener sausage. We show that the log asymptotic behavior up to time t^{β} V(x,t) is V(x,t$, which is analogous to the Euclidean result. Here V(x,t) represents the mass of the ball of radius t about a point x of the local Dirichlet space. The proof uses a known coarse graining technique to obtain the upper asymptotic, but must be adapted to the non-transitive setting. This result provides the first such asymptotics for several other contexts, including diffusions on complete Riemannian manifolds with non-negative Ricci curvature. This is joint work with Melanie Pivarski.

Alejandro Gomez (Rochester)
Uniqueness of stochastic wave equation

This is work in progress. The idea is to study the uniqueness of the solution to the equation X_{tt} = X^a dB, where a is in (1/2, 1). Since the coefficient is not lipschitz the uniqueness for this equation cannot be proven using the usual methods.

Naotaka Kajino (Kyoto)
Heat kernel asymptotics for the measurable Riemannian structure on the Sierpinski gasket

Kigami [Math. Ann. 340 (2008), 781--804] has proposed the notion of `measurable Riemannian structure' on the Sierpinski gasket, where the analogues of the basic objects in Riemannian geometry like gradient vector fields and geodesic metrics have been constructed. He has also proved that the associated heat kernel is subject to the two-sided Gaussian bound in spite of the fractal nature of the space. In the talk more detailed short time asymptotic behaviors of this heat kernel will be established, including Varadhan's asymptotic relation for the logarithm of the heat kernel and a good approximation of it by the usual one-dimensional Gaussian kernel at around each junction point.

Panki Kim (Illinois)
Global Heat Kernel Estimates for Symmetric Jump Processes

In this talk, we discuss the behavior of heat kernel for symmetric jump-type process with jumping kernels comparable to radially symmetric function on the Euclidean space. Sharp two-sided heat kernel estimates for both small and large time will be discussed. This is a joint work with Zhen-Qing Chen and Takashi Kumagai.

Qinghua Li (Columbia)
An Asset Market with Several Large Traders

This work studies the economic notion of imperfect competition in an asset market, by rigorous methods from mathematical finance. The issues of portfolio optimization and execution, hedging of American style options, as well as non-arbitrage and completeness, will be discussed in a continuous-time asset market consisting of small noisy players, small rational investors, and several large traders. The mathematical tools will include stochastic optimizations and backward stochastic differential equations.

Tuan Nguyen (Rutgers)
Self-learning bitmaps: A detailed analysis

Self-learning bitmaps is the algorithm of counting distinct objects, proposed by Aiyou Chen and Jin Cao

from Bell Labs. The algorithm uses the sum of independent geometric distributed random variables as a tool of counting, and the first time of exceeding a given level as an estimate. We provide a complete analysis of this estimation, including its mean, its variance and its asymptotic property via martingale theory approach.

Shun-Xiang Ouyang (Bielefeld)
Non-time-homogeneous Generalized Mehler Semigroups and Applications

A non-time-homogeneous generalized Mehler semigroup on a real separable Hilbert space H is defined through

$$p_{s,t}f(x)=\int_\mathds{H} f(U(t,s)x+y)\,\mu_{t,s}(dy), \quad t\geq s, \ x\in\mathds{H},$$

for every bounded measurable function f on H, where U(t,s) $t \geq s$ is an evolution family of bounded operators on H and \mu_{t,s} is a family of probability measures on H, B(H) satisfying

$$\mu_{t,s}=\mu_{t,r}*\left(\mu_{r,s}\circ U(t,r)^{-1}\right) \text{ for } t \geq r \geq s.$$

A non-time-homogeneous generalized Mehler semigroup is closely corresponded with the transition semigroup of non-autonomous (possibly non-continuous) Ornstein-Uhlenbeck process driven by some proper additive process. We show the infinite divisibility and a Levy-Khintchine type representation of \mu_{t,s}. We also study the corresponding evolution systems of measures (=space-time invariant measures), dimension free Harnack inequality and their applications to derive important properties of p_{s,t}. We prove the Harnack inequality and show the strong Feller property for the transition semigroup of semi-linear non-autonomous Ornstein-Uhlenbeck processes driven by a Wiener process. This is a joint work with Michael Rockner.

Hyein Park (Seoul)
Heat kernel estimates for non-symmetric diffusions]{Two-sided estimates on Dirichlet heat kernels for time-inhomogeneous non-symmetric diffusions with singular drifts in C^{1,\alpha}-domains

In this paper, we establish sharp two-sided estimates for the transition density (or heat kernel) of a large class of time-inhomogeneous Markov process X in C^{1,\alpha} domain. The infinitesimal generator of our X can be formally written as L + \mu \cdot \nabla_x, where L is a uniformly elliptic divergent operator with Dini-continuous coefficients, and \mu is a signed measure on (0,\infty) x R^d belonging to parabolic Kato class. Along the way, a gradient estimate is also established. Our method employs a combination of PDE and perturbation techniques.

Hyunchul Park (Illinois)
Green function estimate for perturbation of subordinated Brownian motion

In this talk, we discuss the perturbation of large class of subordinated Brownian motions. This perturbation is suppressing the Levy measure of the subordinated Brownian motions near the origin and we show that their Green functions are comparable in a bounded connected κ fat domain. This perturbation includes the truncated stable process case.

Parkpoom Phetpradap (Bath)
Large deviations for the range of a simple random walk

For a simple random walk on the integer lattice in dimension d >= 3, we consider the number R(n) of sites visited up to time n. From a law of large numbers of Dvoretzky and Erdos (1950) we know that R(n)/n converges almost surely to κ, the probability that the random walk never returns to the origin. In this paper we show that, for 0<b<κ , we have

\lim_{n\to\infty } n^{-(d-2)/d log P(R_n\le bn) = -(1/d) I^\kappa (b),

where I^\kappa is an explicitly given rate function. This complements an analogous result for the volume of the Wiener sausage, obtained by van den Berg, Bolthausen and den Hollander~(2001), as well as a large deviation result from above due to Hamana and Kesten~(2001).

Melanie Pivarsky (Roosevelt)
Heat Kernels on Riemannian Complexes

A Riemannian complex is a polyhedral complex with the metric structure of Riemannian manifold on each polyhedra. Given bounds on the local geometry of a Riemannian polyhedral complex, we show a uniform local Poincaré inequality holds. These inequalities have a variety of applications, including bounds on the heat kernel and a uniform local Harnack inequality.

Florian Sobieczky (Jena)
Annealed return-probability of the Delayed Random Walk on Critical Percolation Clusters

Polynomial bounds for the expected return-probability on finite percolation clusters in the critical case for the Euclidean lattice are presented. This case is difficult due to the lack of the existence of an integral moment of the cluster-size distribution. We prove a theorem for the convergence rate of finite random walks which enables comparison not only of the spectral gap, but also of `higher eigenvalues' of the involved graph Laplacian. [  F. Sobieczky: `Bounds for the return probability of the delayed random walk on finite percolation clusters in the critical case', arXiv:0812.0117v3]

Christoph Temmel (TU Graz)
Shearer's measure and percolation on trees

Consider the class of bond percolations on an infinite tree with uniformly bounded dependency range k and homogeneous parameter p. We show that Shearer's measure on the k-fuzz of the integers allows us to determine exactly the parameter threshold for almost sure percolation of any such percolation model in terms of the branching number of the tree, extending the results about independent percolation by Lyons and Bollobas/Balister about 1-independent bond percolation.

Joshua Tokle (U Washington)
Heat Kernels of Censored Stable Processes

I will briefly give three constructions of the censored stable process (killing the reflected processes, the Ikeda-Nagasawa-Watanabe piecing together procedure, and a Feynman-Kac transform). A main difficulty in studying this process is that the heat kernels no longer have domain monotonocity: given D_1\subset D_2 it does not necessarily follow that p_{D_1}\le p_{D_2}. I will summarize recent work studying these heat kernels.

Jia-Zeng Wang (Beijing)
A Microscopic Model for Epidemics in Heterogenous Populations

In this paper, a microscopic interacting mechanism is designed for the dynamical epidemic process in heterogenous populations, a Markov process is constructed based on this mechanism. As the population scale trends to infinity, it is proved that almost all trajectories of the stochastic process approximate to the solution of a deterministic ordinary differential equation. The analysis of this deterministic system shows that there exists threshold phenomenon. The microscopic mechanism in this paper represents essentially the long-range effect viewpoint, there are other models based on the local-range effect viewpoint. Here two models based on these two viewpoints are compared numerically.

Brian Whitehead (U Connecticut)
Time spent in sets by stable-like jump processes.

Stable-like jump processes can be expected to spend some time in sets having positive Lebesgue measure. I will talk about this result, and explain how it can be used to extend a Harnack inequality.

Fabio Zucca (Politecnico di Milano)
Applications of approximation techniques to biological models of spatially structured populations

We discuss some applications of the approximation of the critical parameters of branching random walks. We start by considering an interacting particle system on a graph which, from a macroscopic point of view, looks a grid and, at a microscopic level, is a complete graph of degree N (called a patch). There are two birth rates: an inter-patch one and an intra-patch one. We give some results about the phase diagram of this model and we show that, if the size of the patch goes to infinity, then, in the limit, the process behaves like the branching random walk on the grid.