Abstracts

On the L_p boundedness of stochastic singular integral operators
Kim Kyeonghun (Korea University)

Around 1994 Krylov introduced a parabolic Littlewood-Paley inequality. This inequality is used to treat a certain stochastic singular integral operator and becomes the key tool in constructing an L_p-theory for second order SPDEs. In this talk, I will introduce a generalization of Krylov's result. More specifically, I will introduce a stochastic counterpart of the Hörmander condition and Calderón-Zygmund theorem, that is, the stochastic (singular) integral operator of the type $\int_0^t \int_{\mathbf{R}^d} K(t,s,x,y)g(s,y)dydW_s$ becomes a bounded operator on $L_p := L_p(\Omega \times [0,\infty); L_p(\mathbf{R}^d))$ if it is bounded on L_2 and a stochastic version of the Hörmander condition holds. As applications, the maximal L_p-regularity of a wide class of SPDEs will be also introduced.

Global solutions of some singular SPDEs
Masato Hoshino (Waseda University)

By using the theory of paracontrolled calculus, we can obtain the local well-posedness results for some singular stochastic PDEs. In this talk, I explain how to obtain the global well-posedness for two examples: (a) multi-component KPZ equation and (b) 3-dim stochastic CGL equation. A probabilistic approach is used in (a) and an analytic approach is used in (b).

Intermittency and dissipation of stochastic heat equations
Kim Kunwoo (Postech)

Intermittency is usually referred to a phenomenon that shows very tall peaks in small regions and very quiet between tall peaks. In probability, intermittency is defined in terms of moments by Carmona-Molchanov. In this talk, we consider stochastic heat equations which satisfy the intermittency condition by Carmona-Molchanov. We first characterize the quiet areas quantitatively and show that the solution dissipates exponentially fast in a uniform way. This is based on joint work with Davar Khoshnevian, Carl Mueller and Shang-Yuan Shiu.

Box-Ball System with random initial condition and Pitman's $2M-X$ theorem
Sasada Makiko (University of Tokyo)

The box-ball system (BBS for short) was introduced in 1990 by Takahashi and Satsuma as a cellular automaton model that exhibits solitonic behavior. Since then BBS has been studied from various perspectives. The BBS is a discrete time deterministic dynamical system on the state space $\{0,1\}^{\mathbb{N}}$. Recently, Ferrari et.al introduced BBS in $\mathbb{Z}$ and showed that Bernoulli product measures with density less that $\frac{1}{2}$ are invariant under the dynamics, and gave a soliton decomposition for invariant measures. We introduce a new description of the BBS dynamics using a transformation of a simple random walk path, and studied several problems related to BBS in $\mathbb{Z}$ with random initial measures. We give a sufficient condition for the measure to be invariant, and some examples satisfying the condition. Also, we study the distribution of currents at origin, and the position of a tagged particle. Furthermore, we introduce a new continuous version of the BBS (BBS in $\mathbb{R}$), which naturally appears in the scaling limit of the simple random walk. We give the invariance of the distribution of positively drifted Brownian motion under the dynamics. Also, we discuss the relation between our results and the well-known Pitman's theorem for Brownian motion. The talk is based on the joint work with David Croydon, Tsuyoshi Kato and Satoshi Tsujimoto.

Free Energy of Spherical Spin Glass Model
Lee Ji Oon (KAIST)

We consider the spherical spin glass model, which is also known as the spherical Sherrington-Kirkpatrick model. Applying recent results of random matrix theory, we analyze the limiting free energy of the system and the fluctuation around it. We prove the limiting free energy for all parameters rigorously. Moreover, we show that the fluctuation of the free energy converges to a Gaussian distribution at high temperature and to the GOE Tracy-Widom distribution at low temperature. When the ferromagnetic Curie-Weiss interaction is present, we also prove the limiting distributions of the free energy for all parameters. This is a joint work with Jinho Baik.

On convergence of symmetric Dirichlet forms
Uemura Toshihiro (Kansai University)

We will show the Mosco onvergence of symmetric Dirichlet forms on $L^2(G)$ corresponding to symmetric jump-diffusions on an (bounded) open set G of $\mathbb{R}^d$.

Boundary theory of subordinate killed Levy processes
Kim Panki (Seoul National University)

Let Z be a subordinate Brownian motion in $\mathbf{R}^d$, $d \geq 3$,via a subordinator with Laplace exponent ϕ. We kill the process Z upon exiting a bounded open set $D \subset \mathbf{R}^d$ to obtain the killed process Z^D, and then we subordinate the process Z^D by a subordinator with Laplace exponent ψ. The resulting process is denoted by Y^D. Both ϕ and ψ are assumed to satisfy certain weak scaling conditions at infinity. In this talk, I will present some recent results on the potential theory, in particular the boundary theory, of Y^D. First, in case that D is a κ-fat bounded open set, we show that the Harnack inequality holds. If, in addition, D satisfies the local exterior volume condition, then we prove the Carleson estimate. In case D is a smooth open set and the lower weak scaling index of ψ is strictly larger than $1/2$, we establish the boundary Harnack principle with explicit decay rate near the boundary of D. On the other hand, when $\psi(\lambda) = \lambda^\gamma$ with $\gamma \in (0, 1/2]$, we show that the boundary Harnack principle near the boundary of D fails for any bounded $C^{1,1}$ open set D. Our results give the first example where the Carleson estimate holds true, but the boundary Harnack principle does not. We also prove a boundary Harnack principle for non-negative functions harmonic in a smooth open set E strictly contained in D, showing that the behavior of Y^D in the interior of D is determined by the composition $\psi \circ \phi$. This talk is based a joint paper with Renming Song and Zoran Vondracek.

Hydrodynamic Limits of Multiple SLE
Katori Makoto (Chuo University)

Recently del Monaco and Schleißinger addressed an interesting problem whether one can take the limit of multiple Schramm–Loewner evolution (SLE) as the number of slits N goes to infinity. When the N slits grow from points on the real line $\mathbb{R}$ in a simultaneous way and go to infinity within the upper half plane $\mathbb{H}$, they derived an ordinary differential equation describing time evolution of the conformal map $g_t(z)$ for the $N \to \infty$ limit, which is coupled with a complex Burgers equation. It is well known that the complex Burgers equation governs the hydrodynamic limit of the Dyson model defined on $\mathbb{R}$ studied in random matrix theory, and when an infinite number of particles start from the origin, the solution is given by a time-dependent version of Wigner's semicircle law. In the present talk, first we explain time-evolution of the SLE hull K_t in $\mathbb{H}$ in the case that an infinite number of slits start from the origin, which corresponds to the hydrodynamic limit of the Dyson model following Wigner's semicircle law. Then we consider the situation such that there are two sources of infinite numbers of slits with a fixed separation on $\mathbb{R}$. Universal behavior in the long-term limit $t \to \infty$ of K_t in the hydrodynamic limits will be discussed. This is a joint work with Ikkei Hotta (Yamaguchi University).

Metastability without time-reversibility
Seo Insuk (Seoul National University)

We consider several stochastic processes which exhibit the metastability. The metastability is a phenomenon in which a process starting from one of local minima arrives at the neighborhood of the global minimum after a sufficiently long time scale. The precise asymptotic analysis of this transition time has been known only for the reversible dynamics, based on the potential theory of reversible processes. In this presentation, we introduce our recent rigorous metastability analysis for several non-reversible dynamics based on the general form of potential theory. This is based on joint work with Claudio Landim and Mauro Mariani.

Asymptotics of spectral gaps on infinite dimensional spaces
Aida Shigeki (University of Tokyo)

Let E be a smooth function on $\mathbb{R}^N$ and consider the normalized probability measure $\mu_\lambda(dx) = Z_\lambda^{-1} e^{-\lambda E} dx$ on $\mathbb{R}^N$ and a Dirichlet form $\mathcal{E}_\lambda(f,f) = \int_{\mathbb{R}^N} |Df(x)|^2 d\mu_\lambda(x)$ on $L^2(\mathbb{R}^N, \mu_\lambda)$. The asymptotic behavior of the spectral gap of the generator of $\mathcal{E}_\lambda$ as $\lambda \to \infty$ and related asymptotic problems of the spectrum of Schrödinger operators $-\Delta + \lambda^2 U$ on $L^2(\mathbb{R}^N, dx)$ have been studied by many researchers and many important results are obtained. In this talk, we discuss infinite dimensional version of this problem *e.g.* in the cases of loop spaces and spatially cut-off $P(\phi)_2$-Hamiltonians.