Seventh Bielefeld-SNU Joint Workshop in Mathematics Abstracts

February 26 – March 1, 2019

Mosco convergence of nonlocal to local quadratic forms

Guy Fabrice Foghem Gounoue

We study sequences of nonlocal quadratic forms and function spaces that are related to Markov jump processes in bounded domains with a Lipschitz boundary. Our aim is to show the convergence of these forms to local quadratic forms of gradient type. Under suitable conditions we establish the convergence in the sense of Mosco. Our framework allows to study bounded and unbounded nonlocal operators at the same time. Moreover, we prove that smooth functions with compact support are dense in the nonlocal function spaces under consideration.

On the division problem for wave maps

Sebastian Herr

Tataru's approach to wave maps in the critical Besov space is revisited. A new solution to the division problem via bilinear Fourier restriction estimates and atomic function spaces will be presented.

Estimates of Dirichlet heat kernels for unimodal Lévy processes with low intensity of small jumps

Jaehoon Kang

In this talk, we discuss transition density functions for pure jump unimodal Lévy processes killed upon leaving an open set D. In analytic point of view, the transition density function is Dirichlet heat kernel for infinitesimal generator of the corresponding Lévy processes. Under some mild assumptions on the Lévy density, we establish two-sided Dirichlet heat kernel estimates when the open set D is $C^{1,1}$. This result covers the case that the Lévy densities of unimodal Lévy processes are regularly varying functions whose indices are equal to the Euclidean dimension. This is a joint work with Soobin Cho and Panki Kim.

Spectral analysis of non-local Markov generators

Yuri Kondratiev

We study generators of random walks in the continuum and their potential perturbations. Main problems which will be discussed: the existence and properties of ground states, resolvent bounds, heat kernels for non-local generators. Applications to certain real world models will be a subject of our considerations.

Metastability of interacting particle systems

Claudio Landim

We present the metastable behavior of certain interacting particle systems. We first examine the evolution of the condensate in a class of zero-range processes evolving in a finite set, and describe its nucleation phase. In the second part of the talk, we consider the metastable behavior of the Ising model under the Kawasaki dynamics.

Sobolev spaces and calculus of variations on fractals

Melissa Meinert

In this talk, we will review $p-$energies and $(1,p)-$Sobolev spaces for fractals and metric measure spaces that carry a local Dirichlet form. These Sobolev spaces are then used to generalize some basic results from the calculus of variations, such as the existence of minimizers of convex functionals.

On Cherny's results in infinite dimensions: A theorem dual to Yamada-Watanabe

Marco Rehmeier

We prove that joint uniqueness in law and the existence of a strong solution imply pathwise uniqueness for variational solutions to stochastic partial differential equations of the form

$$\mathrm{d}X_t = b(t,X)\mathrm{d}t + \sigma(t,X)\mathrm{d}W_t, \;\; t \geq 0,$$

and show that for such equations uniqueness in law is equivalent to joint uniqueness in law. Here W is a cylindrical Wiener process in a separable Hilbert space U and the equation is considered in a Gelfand triple $V \subseteq H \subseteq E$, where H is some separable (infinite-dimensional) Hilbert space. This generalizes the corresponding results of A. Cherny for the case of finite-dimensional equations.

Parabolic stochastic partial differential equations driven by Lévy noise

Andre Schenke

We study second-order quasi-linear SPDEs on C^1 domains subjected to Lévy noise. We prove uniqueness and existence of solutions in (weighted) Sobolev spaces and obtain L_p and Hölder estimates of both the solution and its gradient. This is a joint work with K.H. Kim.

New regularity results for dispersive PDE on tori via shorttime Strichartz estimates

Robert Schippa

In Euclidean space linear dispersive PDE are characterized by a decay estimate and conservation of mass. On compact manifolds mass is still conserved, but the decay estimate can not hold globally in time because this would contradict mass conservation. In now already classical works by Burq-Gerard-Tzvetkov (2004) and Staffilani-Tataru (2002) was pointed out how localization in time to small frequency dependent time intervals recovers the dispersive estimate. These considerations are combined with shorttime function spaces utilized in Ionescu-Kenig-Tataru (2008) for solutions on Euclidean space. New regularity results for dispersive PDE on tori from the preprints arXiv:1704.07174 and arXiv:1810.04406 are presented.

Homogenization of biased convolution type operators

Elena Zhizhina

I will tell about results from our recent work with A. Piatnitski, where we studied homogenization of the parabolic problem for integral convolution type operators with a non-symmetric jump kernel in a periodic elliptic medium. It was shown that the homogenization result holds in moving coordinates. We found the corresponding effective velocity and proved that the limit operator is a second order parabolic operator with constant coefficients. We also considered the behaviour of the effective velocity in the case of small antisymmetric perturbations of a symmetric kernel, in particular we showed that the Einstein relation holds for the studied periodic environment.