Interplay of Random Media and Stochastic Interface Models (RMSI2018)

TU Berlin, June 25 – 27, 2018

Workshop program

Program

Monday, 25. June: **H 2036**

09:00	*Registration*
09:30	*Opening of the Workshop*
09:45	**Tadahisa Funaki** Motion by mean curvature from Glauber-Kawasaki dynamics.
10:30	*Coffee Break*
11:00	**Erwin Bolthausen** A second moment method for high temperature mean-field spin glasses.
11:45	**Amir Dembo** Averaging principle and shape theorem for growth with memory.
12:30	*Lunch (Self Catered)*
14:00	**Alejandro Ramírez** Universal scaling of random walks at low disorder.
14:45	**Pierre-François Rodriguez** Random walks on dynamical percolation clusters and other degenerate environments.
15:30	*Coffee Break*
16:00	**Ryoki Fukushima** Geometry of the random walk range conditioned on survival among Bernoulli obstacles.
17:00	*Time for discussions*
18:00	*Reception*

Tuesday, 26. June: **HBS 005**

09:00	**Martin Barlow** Stability of the elliptic Harnack Inequality.
09:45	**Takashi Kumagai** Quenched invariance principle for random walks among random conductances with stable-like jumps.
10:30	*Coffee Break*
11:00	**Nina Gantert** Biased random walk among random conductances.
11:45	**Noam Berger** Balanced environments with Deuschel.
12:30	*Lunch (Self Catered)*
14:00	**Jason Miller** Random walk on random planar maps.
14:45	**Ofer Zeitouni** Liouville Brownian motion exponents and graph distance.
15:30	*Coffee Break*
16:00	**Alain-Sol Sznitman** On macroscopic holes in some dependent percolation models.

Wednesday, 27. June: **HBS 005**

09:00	**Codina Cotar** Equality of the Jellium and Uniform Electron Gas next-order asymptotic terms for Riesz potentials.
09:45	**Gérard Ben Arous**
10:30	*Coffee Break*
11:00	**Giambattista Giacomin** On two dimensional Ising model with columnar disorder and singular behavior of Lyapunov exponents.
11:45	**Frank den Hollander** Spatially extended pinning.
12:30	*Conclusion of the Workshop*

Speaker Abstracts

Martin Barlow (University British Columbia)

Stability of the elliptic Harnack Inequality.

Following the work of Moser, as well as de Giorgi and Nash, Harnack inequalities have proved to be a powerful tool in PDE as well as in probability. In the early 1990s Grigor'yan and Saloff-Coste gave a characterisation of the parabolic Harnack inequality (PHI). This characterisation implies that the PHI is stable under bounded perturbation of weights, as well as rough isometries. In this talk we prove the stability of the EHI. The proof uses the concept of a quasi symmetric transformation of a metric space, and the introduction of these ideas to Markov processes suggests a number of new problems. This is joint work with Mathav Murugan (UBC).

Gérard Ben Arous (New York University)

Noam Berger (TU München)

Balanced environments with Deuschel.

I have written three papers with Deuschel, all on the same model, namely random walk on a (not necessarily elliptic) balanced environment. In the talk I'll discuss the various results, namely an invariance principle, a Harnack inequality and quantitative homogenisation.

Erwin Bolthausen (University Zürich)

A second moment method for high temperature mean-field spin glasses.

It is well known that in mean-field spin glasses, the annealed free energy typically does not agree with the quenched one, even at high temperature. We propose a suitable conditioning argument which leads to an evaluation of the quenched free energy by a conditional second moment method. The proper conditioning is on the solution of the TAP equations. It has been worked out for the SK-model, and (partially) for the perceptron. The latter is work in progress with Shuta Nakaijma (Kyoto University).

Codina Cotar (University City London)

Equality of the Jellium and Uniform Electron Gas next-order asymptotic terms for Riesz potentials.

We consider two sharp next-order asymptotics problems, namely the asymptotics for the minimum energy for optimal point con figurations and the asymptotics for the many-marginals Optimal Transport, in both cases with Coulomb and Riesz costs with inverse power-law long-range interactions. The first problem describes the ground state of a Coulomb or Riesz gas, while the second appears as a semi-classical limit of the Density Functional Theory energy modelling a quantum version of the same system. Recently the second-order term in these expansions was precisely described, and corresponds respectively to a Jellium and to a Uniform Electron Gas model. The present work shows that for inverse-power-law interactions with power $d-2 < s < d$, the two problems have the same minimum. This is based on joint works with Mircea Petrache (ETH/Santiago).

Amir Dembo (University Stanford)

Averaging principle and shape theorem for growth with memory.

We consider a family of random growth models in n-dimensional space. These models capture certain features expected to manifest at the mesoscopic level for certain self-interacting microscopic dynamics (such as once-reinforced random walk with strong reinforcement and origin-excited random walk).

In a joint work with Pablo Groisman, Ruojun Huang and Vladas Sidoravicius, we establish for such models an averaging principle and deduce from it the convergence of the normalized domain boundary, to a limiting shape. The latter is expressed in terms of the invariant measure of an associated Markov chain.

Frank den Hollander (University Leiden)

Spatially extended pinning

We consider a directed polymer interacting with a linear interface. The monomers carry random charges. Each monomer contributes an energy to the interaction Hamiltonian that depends on its charge as well as its height with respect to the interface, modulated by an interaction potential. The configurations of the polymer are weighted according to the Gibbs measure associated with the interaction Hamiltonian at a given inverse temperature, where the reference measure is given by a recurrent Markov chain.

We are interested in both the quenched and the annealed free energy per monomer in the limit as the polymer becomes large. We find that each exhibits a phase transition along a critical curve separating a localized phase (where the polymer stays close to the interface) from a delocalized phase (where the polymer wanders away from the interface). We obtain variational formulas for the critical curves, and find that the quenched phase transition is at least of second order. We obtain upper and lower bounds on the quenched critical curve in terms of the annealed critical curve. In addition, for the special case where the reference measure is given by a Bessel random walk, we identify the weak disorder scaling limit of the annealed free energy and the annealed critical curve in three different regimes for the tail exponent of the interaction potential. Based on joint work with Francesco Caravenna (University of Milano-Bicocca, Italy)

Ryoki Fukushima (RIMS, Kyoto University)

Geometry of the random walk range conditioned on survival among Bernoulli obstacles.

Consider a discrete time simple symmetric random walk among Bernoulli obstacles on the integer lattice, where the walk is killed when it hits an obstacle. It is known that conditioned on survival up to long time, the random walk is localized in a ball that is mach smaller than the diffusive scaling. In the dimension less than or equal to two, it is also known that the range asymptotically contains a slightly smaller ball, while the higher dimensional case remains open. We complete the picture by showing that in any dimension, the random walk range covers the localization ball except for near the boundary. Furthermore, we obtain an upper bound on the boundary of the range.

Tadahisa Funaki (Waseda University/University of Tokyo)

Motion by mean curvature from Glauber-Kawasaki dynamics.

We derive the motion by mean curvature directly from a particle system on a periodic square lattice called Glauber-Kawasaki dynamics. Our method relies on an estimate on the relative entropy of the system. This is joint work with Kenkichi Tsunoda.

Nina Gantert (TU München)

Biased random walk among random conductances.

We discuss the velocity of Mott variable range hopping with an external field, as well as the velocity of biased random walk among random conductances. We

give results on the Einstein relation, and more generally on the derivative of the velocity as a function of the bias. In the random conductance case, we show that both monotonicity and non-monotonicity can occur. The talk is based on joint works with Alessandra Faggionato and Michele Salvi, and on joint work with Noam Berger and Jan Nagel.

Giambattista Giacomin (Université Paris Diderot)

On two dimensional Ising model with columnar disorder and singular behavior of Lyapunov exponents.

The two dimensional Ising model with "columnar disorder" (McCoy-Wu model) often takes the center of the stage when approaching the challenging issue of understanding the effect of disorder on phase transitions and critical phenomena. I will overview what is known/conjectured about the McCoy-Wu model and explain why the exact solvability claim, often associate to this model, is an overstatement. The solvability aspect in fact is the reduction of the problem to another one – the computation of the Lyapunov exponent of a certain product of two by two random matrices – that looks much easier. In collaboration with Francis Comets and Rafael Greenblatt, we have made some progress toward understanding this product of random matrices. The main aim of the talk is explaining these results and what they do and do not imply on the two dimensional Ising model with columnar disorder.

Takashi Kumagai (RIMS, Kyoto University)

Quenched invariance principle for random walks among random conductances with stable-like jumps.

Consider random conductances that allow long range jumps. In particular we consider conductances $C_{xy} = \omega_{xy}|x-y|^{-d-\alpha}$ for distinct $x, y \in \mathbb{Z}^d$ and $0 < \alpha < 2$, where $\{\omega_{xy} = \omega_{yx} : x, y \in \mathbb{Z}^d\}$ are non-negative independent random variables with mean 1. We prove that under some moment conditions for ω, suitably rescaled Markov chains among the random conductances converge to a rotationally symmetric α-stable process almost surely w.r.t. the randomness of the environments. The proof is a combination of analytic and probabilistic methods based on the recently established de Giorgi-Nash-Moser theory for processes with long range jumps. If time permits, we also discuss quenched heat kernel estimates as well. This is a joint work with Xin Chen (Shanghai) and Jian Wang (Fuzhou).

Jason Miller (University Cambridge)

Random walk on random planar maps.

We study random walk on a class of random planar maps which includes the UIPT and the UST-decorated random planar map. We obtain subpolynomial bounds for the growth of the Greens function and the effective resistance to the boundary of a metric ball. We also show that the spectral dimension of these maps is almost surely equal to 2. Based on joint work with Ewain Gwynne.

Alejandro Ramírez (University Santiago de Chile)

Universal scaling of random walks at low disorder.

We consider random walks at low disorder. We show that under an appropriate scaling of the disorder, space and time, the quenched transition probabilities converge in distribution to the solution of the stochastic heat equation (joint work with G. Moreno and J. Quastel).

Pierre-François Rodriguez (UC Los Angeles)

Random walks on dynamical percolation clusters and other degenerate environments.

We will consider random walks among dynamical random conductances (on cubic lattices), which are assumed bounded (say by one) but otherwise just jointly ergodic with respect to space-time shifts. Importantly, the conductances are allowed to vanish for non-trivial intervals of time so the walk may be stuck in small regions for long periods of time. I will sketch the proof of convergence of this walk to a non-degenerate Brownian motion under diffusive scaling of space and time based only on the assumption that the time to accumulate unit conductance on a given edge has sufficiently high moments. In particular, this proves Brownian scaling for random walks in a class of dynamical percolation models. It also applies to certain environments arising in the Helffer-Sjstrand representation for gradient models with non-strictly convex potentials. Joint work with Marek Biskup.

Alain-Sol Sznitman (ETH Zürich)

On macroscopic holes in some dependent percolation models.

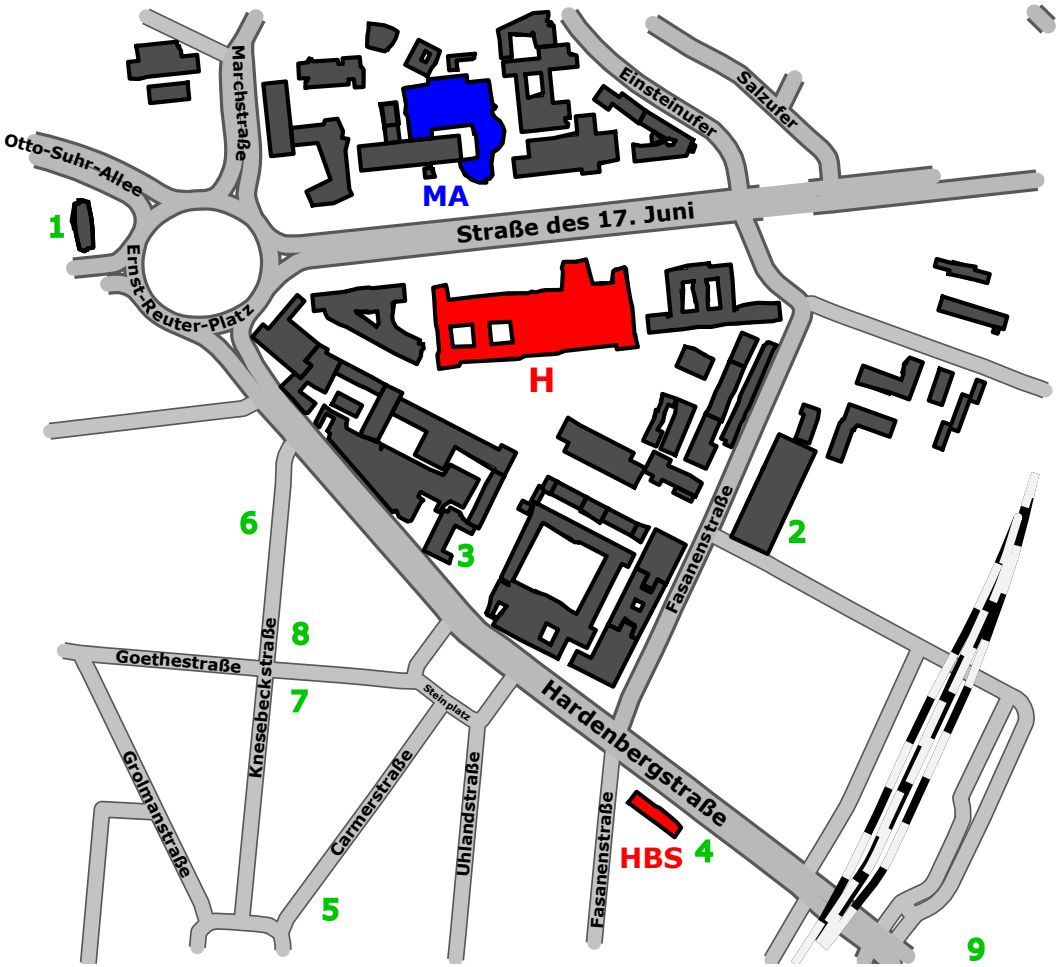
We consider on $\mathbb{Z}^d$, $d \geq 3$, the vacant set of random interlacements in the strongly percolative regime, the vacant set of the simple random walk, and the excursion set of the Gaussian free field in the strongly percolative regime. We

present asymptotic upper and lower exponential bounds for the large deviation probability that the adequately thickened component of the boundary of a large box centered at the origin in the respective vacant sets or excursion set leaves in the box a macroscopic volume in its complement, as well as some geometric controls on the shape of the left-out volume.

Ofer Zeitouni (New York University/Weizmann Institute of Science Rehovot)

Liouville Brownian motion exponents and graph distance.

We prove that the short time asymptotics of the Liouville heat kernel satisfy asymptotics of the form $\log\log p_t(x,y)/\log|\log t| \to \chi$, and relate the exponent ξ to the scaling exponent for the graph distance determined by the underlying Gaussian multiplicative chaos (which is also shown to exist). Combined with known bounds on the latter, this disproves a prediction based on Watabiki's formula for the latter. Joint work with Jian Ding and Fuxi Zhang.



Conference venue and restaurants nearby

- H TU Berlin, Main building, Strasse des 17. Juni 135
- HBS TU Berlin, HBS building, Hardenbergstraße 16-18
- 1 Cafeteria TU "Skyline", Ernst-Reuter-Platz 7
- 2 café nero, Fasanenstraße 88
- 3 Mensa TU, Hardenbergstraße 34
- 4 Ishin, Hardenbergstraße 19
- 5 Dicke Wirtin, Carmerstraße 9
- 6 Manjurani, Knesebeckstraße 4
- 7 Restaurante Ciao Itali, Goethestraße 84
- 8 Pasta & Basta, Knesebeckstraße 94
- 9 Kantini (Food-Court Bikini Haus), Budapester Straße 38-50