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FAKULTÄT FÜR MATHEMATIK
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Einladung zur öffentlichen Defensio von

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Thema der Dissertation:

On Some Aspects of Random Walks in Random Environments: Trapping, Scaling Limits, Aging, and Percolation

Abstract:
This thesis consists of three research papers which deal with various aspects of random walks in random environments. In the first part we consider two types of Markov chains that exhibit trapping, and we study associated scaling limits and the phenomenon of aging. In the second part we analyze percolative properties of the set of vertices that are not visited by the simple random walk on a finite graph, the so-called vacant set.
The first paper studies the Metropolis dynamics of the simplest mean-field spin glass model, the Random Energy Model. We show that this dynamics exhibits aging by showing that the properly rescaled time-change process between the Metropolis dynamics and a suitably chosen 'fast' Markov chain converges in distribution to a stable Lvy process. This provides a first proof for aging of a fully 'asymmetric' dynamics on the non-modified Random Energy Model.
The result of the second paper is a complete classification of the possible scaling limits of randomly trapped random walks on ^{d}, $d \geq 2$. We show that the possible classes of scaling limits reduce from four in one dimension to only two in higher dimensions. In particular, in the case when the discrete skeleton of the randomly trapped random walk is a simple random walk on $\mathbb{Z}^d$, the scaling limit is either Brownian motion or the Fractional Kinetics process.
In the third paper we show that the vacant set left by the simple random walk on the giant component of a supercritical Erdős-Rényi random graph exhibits a phase transition similar to the classical phase transition of Bernoulli percolation on the complete graph. Moreover, we show that the critical point of this phase transition is closely related to the critical value of random interlacements on the corresponding infinite volume limit, which is a Poisson-Galton-Watson tree.

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