

REPORT ON SHORT VISIT GRANT RGLIS 5329

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The aim of the visit to Aix-Marseille Université was to make progress with a joint project with Nina Gantert from Technische Universität München and Sebastian Müller from Aix-Marseille Université. Our goal is to prove the Einstein relation in a one-dimensional percolation model introduced by Axelson-Fisk and Häggström [1]. The famous Einstein relation connects two important quantities characterizing the behavior of a particle moving in a medium, namely, the *diffusivity* and the *mobility*. Here, the diffusivity means the diffusivity in equilibrium and the mobility is the derivative of the velocity under a small perturbation. The underlying percolation model can be described as i.i.d. bond percolation on the infinite ladder graph (with vertex set $\mathbb{Z} \times \{0, 1\}$) conditioned on the existence of an infinite path.

The first step towards proving the Einstein relation is the proof of the central limit theorem for the unbiased random walk on the infinite percolation cluster. We completed this step by proving an invariance principle for this walk and by deriving bounds on the limiting diffusivity.

In order to improve our understanding of the biased random walk on the infinite percolation cluster, which need to be investigated to derive bounds on the speed, we have started working on an invariance principle for this walk as well.

The preliminary results obtained so far should enable us to write a joint publication on invariance principles for random walks in the one-dimensional percolation model in the near future. The proof of the Einstein relation for this model is still in an early stage. However, we will carry on our work on this project.

References

- [1] M. Axelson-Fisk and O. Häggström. Conditional percolation on one-dimensional lattices. *Adv. in Appl. Probab.*, 41(4):1102–1122, 2009.