

YEP XII Workshop

Random Walks in Random Environment

Scientific Report

1 Summary

Date: March 23 – March 27, 2015
Location: EURANDOM, Eindhoven, the Netherlands
Organizers: Alexander Drewitz (Columbia University)
Markus Heydenreich (Universität München)
Logistics: Patty Koorn (EURANDOM, Eindhoven)

Description. This was the 12th workshop in the highly successful *Young European Probabilists (YEP)* workshop series hosted at EURANDOM. It formed part of the Stochastic Activity Month at EURANDOM on Random Walk in Random Environment and has been organized by Alexander Drewitz and Markus Heydenreich. The workshop consisted of 3 mini courses, each of 3 times 1.5 hours, and of various talks of 35 minutes each, by both, junior and more experienced researchers in the field. The workshop hosted 46 participants, which shows the relevance of the topic and attractivity within the research community.

Following the tradition, this 12th YEP workshop gave young probabilists ample opportunity to expand their network and gain international experience. Further, for many of the young participants, the mini-courses provide a spring school through which they benefitted to a much larger extent from the senior workshops that followed it in the above-named framework of the Stochastic Activity Month.

Mini-courses. The workshop featured three minicourses by world leading experts in the field of random walk in random environment:

- Noam Berger (Munich): The strongly ballistic phase for random walk in random environment
- David Croydon (Warwick): Scaling limits of random walks on critical random trees and graphs
- Vladas Sidoravicius (Rio de Janeiro): Random walks in dynamic environment - mutual interaction case

Berger's course centered around the classical questions of random walk in static environment, Sidoravicius discussed new developments in the case of dynamic environments, and Croydon gave a survey on random walk on random graphs with particular emphasize on their scaling limits.

2 Scientific content and impact

Random walk in random environment (RWRE) has originally been introduced in the early second half of the last century as a model for motions in disordered media, for the replication of DNA chains, and for phase transitions in alloys, among others. While the area has initially developed not too fast, in particular the last two decades have resulted in significant progress and a much deeper understanding. In fact, it has attracted significant mathematical attention and has undergone a major development, where, among others, results on limiting velocities, scaling limits, and large deviations have been established.

Meanwhile, RWRE has turned out to be a simple model that exhibits a variety of complex large-scale phenomena arising in biology and engineering, physics, and field theory, see e.g. Giacomin [Gia02] Sumino et al. [SMHY05], Funaki [Fun05], Sheffield [She05], Velenik [Vel06], He et al. [HBMB08], or also Goncharenko and Gopinathan [GG10].

The proposed workshop will focus on the following three varieties of RWRE:

- ‘classical’ random walk in random environment;
- random walks on random graphs;
- random walk in dynamic random environment.

In many regards, the one-dimensional settings of these models are by now more or less well-understood, whereas in higher dimensions the picture still is much less developed. We refer to Bolthausen and Sznitman [BS02], Sznitman [Szn04], Zeitouni [Zei04], Biskup [Bis11], as well as Drewitz and Ramírez [DR14] for recent reviews of different foci of the subject. With respect to random walks in dynamic random environment, Avena, den Hollander and Redig [AdHR10] and the sources given there serve as an up-to-date account on the topic.

On the one hand, there are many aspects that actually do distinguish the three different foci mentioned above. For example, classical RWRE in dimensions $d \geq 2$ and random walk in dynamic random environment are generally not reversible, whereas random walks on random graphs are (and this gives powerful connections to harmonic analysis and electrical networks, see Doyle and Snell [DS84] for further details). On the other hand, however, many tools (such as, e.g., renormalization group techniques) have turned out to be applicable in all three of the foci; in particular, having researchers from all three foci attending the YEP workshop, fruitful discussions and mutual synergies have developed throughout the entire week and beyond.

As alluded to in the summary already, the YEP workshop has been embedded in the ‘Stochastic Activity Month: Random Walks in Random Environment’ at EURANDOM. To be more precise, the YEP workshop was directly followed by two further workshops, one on ‘random walks and random media’ and one on ‘random walks on graphs with applications’. It was very fortunate that a number of participants of the YEP took advantage of the framework of the Stochastic Activity Month by participating in at least one of the other two workshops of that month also.

One of our main focus was to create an atmosphere that encouraged discussion particularly among the junior participants. For this purpose, we have scheduled a reception at the first evening to spark off the discussions, a conference dinner at the second evening, and long lunch breaks at every day of the workshop. Moreover, the participants formed a balanced mix of few senior experts (most notably the mini-course speakers Noam Berger, David Croydon, and Vladas Sidoravicius as well as Jiří Černý and Alejandro Ramírez), and many early career researchers on the other hand.

The (recently renewed) EURANDOM provided an excellent location for a mid-size workshop of this type. Logistics support was superb, and the close vicinity of the lecture hall and lounge provided ample opportunities for informal discussions. The organizers received numerous positive feedback about the workshop from the participants, who praised in particular the open and inspiring atmosphere and the high level of the oral contributions. We conclude that our aim of creating a workshop over cutting edge research in Random Walks in Random Environment with strong interaction between participants was fully achieved.

References

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3 Final program

Monday March 23

09.00 - 09.30	Registration and welcome coffee	
09.30 - 11.00	Noam Berger	The strongly ballistic phase for random walk in random environment (1)
11.30 - 13.00	Vladas Sidoravicius	Random walks in dynamic environment - mutual interaction case (1)
12.30 - 15.00	Lunch	
15.00 - 15.35	Sebastian Müller	Rotor-routing on Galton-Watson trees
15.35 - 16.10	Francois Simenhaus	Random walk driven by simple exclusion process
16.30 - 17.05	Stein Bethuelen	Random Walk on Attractive Spin-Flip Dynamics
17.05 - 17.40	Alejandro Ramirez	Quenched CLT for random walk in ergodic space-time environment
17.40 - 19.00	Reception	

Tuesday March 24

09.00 - 10.30	Vladas Sidoravicius	Random walks in dynamic environment - mutual interaction case (2)
11.00 - 12.30	David Croydon	Scaling limits of random walks on critical random trees and graphs (1)
12.30 - 15.00	Lunch	
15.00 - 15.35	Tobias Wassmer	Aging of the Metropolis dynamics on the Random Energy Model
15.35 - 16.10	Pierre-F. Rodriguez	On level-set percolation for the Gaussian free field
16.30 - 17.05	Renato S. dos Santos	Mass concentration in the parabolic Anderson model w. doubly-exponential tails
17.05 - 17.40	Tal Orenshstein	
18.30 -	Conference dinner	

Wednesday March 25

09.00 - 10.30	Noam Berger	The strongly ballistic phase for random walk in random environment (2)
11.00 - 12.30	Vladas Sidoravicius	Random walks in dynamic environment - mutual interaction case (3)
12.30 - 15.00	Lunch	
15.00 - 15.35	Martin Slowik	Random conductance model in a degenerate ergodic environment: Invariance principle and heat kernel behaviour
15.35 - 16.10	Ron Rosenthal	Quenched invariance principle for simple random walk on clusters of correlated percolation models
16.30 - 17.05	Dirk Erhard	The parabolic Anderson model in a dynamic random environment: random conductances
17.05 - 17.40	Julia Komjathy	Fixed speed competition on the configuration model with ∞ -variance degrees

Thursday March 26

09.00 - 10.30	David Croydon	Scaling limits of random walks on critical random trees and graphs (2)
11.00 - 12.30	Noam Berger	The strongly ballistic phase for random walk in random environment (3)
12.30 - 15.00	Lunch	
15.00 - 15.35	Jan Nagel	The Einstein relation in the random conductance model
15.35 - 16.10	Oriane Blondel	Random walks on the East model
16.30 - 17.05	Michele Salvi	The law of large numbers for the Variable Range Hopping model
17.05 - 17.40	Brett Kolesnik	The Cut Locus of the Brownian Map: Continuity and Stability

Friday March 27

09.00 - 10.30	David Croydon	Scaling limits of random walks on critical random trees and graphs (3)
11.00 - 11.35	Atilla Yilmaz	Variational formulas and disorder regimes of random walks in random potentials
11.35 - 12.10	Onur Gün	Branching random walks in random environments on hypercubes
12.10 - 12.45	Jiri Cerny	Ancestral lineages in spatial populations: Over the oriented random walk on oriented percolation cluster

4 Abstracts

All abstracts can be found on

http://www.eurandom.nl/events/workshops/2015/SAM%20MAART%202015/YEP_2015.html#Abstracts

5 Participants

First name	Last name	Affiliation
Murtuza Ali	Abidini	TU Eindhoven
Gerardo	Barrera Vargas	IMPA Rio de Janeiro
Noam	Berger	TU Munich / Hebrew University Jerusalem
Stein Andreas	Bethuelsen	Leiden University & CWI Amsterdam
Johannes	Blank	Universität Münster
Oriane	Blondel	University of Lyons
Adam	Bowditch	University of Warwick
Wouter	Cames van Batenburg	Radboud Universiteit
Jiri	Cerny	University of Vienna
Marcelo	Costa	Durham University
David	Croydon	University of Warwick
Souvik	Dhara	University of Technology, Eindhoven
Alexander	Drewitz	Columbia University
Dirk	Erhard	Warwick University
Artiom	Fiodorov	University College London
Franziska	Flegel	WIAS Berlin
Onur	Gün	WIAS Berlin
Markus	Heydenreich	LMU Munich
Stefan	Junk	TU Munich
Brett	Kolesnik	University of British Columbia
Sándor	Kolumbán	TU Eindhoven
Julia	Komjathy	TU Eindhoven
Ivan	Kryven	University of Amsterdam
Anshui	Li	Utrecht University
Chak Hei	Lo	Durham University
Katja	Miller	TU Munich
Decebal Constantin	Mocanu	TU Eindhoven
Sebastian	Mueller	Université Aix-Marseille / I2M
Debankur	Mukherjee	TU Eindhoven
Jan	Nagel	TU Munich
Francesca Romana	Nardi	TU Eindhoven
Tal	Orenshtein	University Lyon 1
Alejandro	Ramírez	PUC de Chile / TU Berlin
Pierre-François	Rodriguez	ETH Zurich
Ron	Rosenthal	ETH Zurich
Michele	Salvi	TU Munich
Renato	Santos	WIAS Berlin
François	Simenhaus	Université Paris Dauphine
Martin	Slowik	TU Berlin
Clara	Stegehuis	TU Eindhoven
Sebastian	Steiber	TU Munich
John	Sylvester	University of Warwick
Florian	Vllering	TU Berlin
Tobias	Wassmer	University of Vienna
Felizitas	Weidner	TU Munich
Atilla	Yilmaz	Boğaziçi University