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<http://www.springer.com/978-3-0346-0243-3>

Random Walks, Boundaries and Spectra

(Eds.) D. Lenz; F. Sobieczky, W. Woess

2011, XXVI, 325 p., Hardcover

ISBN: 978-3-0346-0243-3

A product of Springer Basel

Preface

This book contains the joint proceedings of the workshop on **Boundaries** that took place in Graz, from June 29–July 3, and the **Alp-Workshop** that was held immediately afterwards in Sankt Kathrein am Offenegg, on the weekend July 4–5, 2009.

The two events were dedicated to related subjects.

The aim of the **Boundaries** workshop was to bring together mathematicians working on groups, graphs, manifolds, etc., in the context of probability (random walks, Brownian motion), harmonic analysis, potential theory, ergodic theory, geometric group theory and related topics. The title indicates a central topic but was not to be considered the exclusive theme.

The scientific committee of the meeting consisted of Tatiana Nagnibeda-Smirnova (Geneva), Christophe Pittet (Marseille), Hamish Short (Marseille), and Wolfgang Woess (Graz).

The local organisation rested on the shoulders of Ecaterina Sava and Wolfgang Woess at Graz University of Technology in the capital of Styria, southeastern province of Austria.

Three special guests were particularly featured in view of their “milestone birthdays” taking place in 2009:

- Donald I. Cartwright (Sydney; 60th birthday)
- Vadim A. Kaimanovich (Bremen; 50th birthday)
- Massimo Picardello (Rome; 60th birthday)

Each of these three has given substantial contributions to the mathematical subject of the workshop, and to each of them, a half-day session was dedicated, featuring in particular their own (respective) invited talks. In the present volume, we display their lists of publications (state of September, 2010).

The **Alp-Workshop 2009** was devoted to “Spectral and probabilistic properties of random walks on random graphs”. The aim was a discussion between experts from spectral theory, ergodic theory and probability theory about the special topics of random walk theory in which the methods from group theory and harmonic analysis fail: Discrete structures with much irregularity, such as Percolation, Random Graphs, or Branching Processes were the main focus. Instead of a detailed discussion of each talk we refer to the attached programme. During the

first afternoon-session, there were six twenty-minutes talks by young researchers of whom several have contributed to the proceedings.

The Alp-Workshop was organised by Florian Sobieczky with the budget of project P18703 (“Random Subgraphs of Transitive Graphs”) of the Austrian Science Foundation (FWF). Furthermore, the main part of the publication cost of these proceedings was carried by the budget of this research project.

The “Almenland” in the mountains east of Graz provided a picturesque environment for the interdisciplinary discussion about random walks. Its remoteness allowed inviting more people with the given budget while keeping a high standard of the venue.

The editing of the proceedings contributed by the Alp-Workshop’s participants was undertaken by Daniel Lenz and Florian Sobieczky. The contributions from the Boundaries-Workshop were edited by Wolfgang Woess. All articles underwent anonymous refereeing by experts from the respective field.

We would like to thank everyone who was directly or indirectly involved in helping to organise these meetings.

This volume is dedicated to



Donald I. Cartwright



Massimo A. Picardello



Vadim A. Kaimanovich

October 2010,

Daniel Lenz
Florian Sobieczky
Wolfgang Woess

Programme of the Workshop on “Boundaries”

June 29th (Mon.)

- 09:00–09:10 Opening
- 09:10–10:10 **Francois Ledrappier**, University of Notre Dame
Linear drift for the Brownian motion on covers
- 10:10–10:40 Coffee & Registration
- 10:40–11:10 **Martin Dunwoody**, University of Southampton
An inaccessible graph
- 11:20–11:50 **Panos Papazoglou**, University of Athens
Topology of boundaries and splittings
- 12:00–12:20 **Barbara Bobikau**, University of Wroclaw
Spectral properties of a class of random walks on locally finite groups
- 12:20–14:30 Lunch
- 14:30–15:20 **Massimo Picardello**, Tor Vergata University in Rome
Harmonic functions on homogeneous trees and buildings
- 15:30–16:00 **Sara Brofferio**, University of Paris-Sud 11
Poisson boundary of matrix groups with rational coefficients
- 16:10–16:40 Coffee
- 16:40–17:30 **Yves Guivarc’h**, University of Rennes
Random walk in a random medium on Z , and random walks on homogeneous spaces
- 17:40–18:00 **Daniele D’Angeli**, University of Geneva
The boundary action of the Basilica group

June 30th (Tue.)

- 09:30–09:50 **Tim Riley**, Cornell University
How wild can a group with a quadratic Dehn function be?
- 10:00–10:30 Coffee
- 10:40–11:11 **Anton Thalmaier**, University of Luxembourg
The Poisson boundary of certain Cartan-Hadamard manifolds of unbounded curvature
- 11:20–11:50 **Alexander Gnedin**, Utrecht University
Boundaries of the generalised Pascal triangles and larger graded graphs
- 12:00–12:20 **Jeremy Macdonald**, McGill University
Compressed words and automorphisms in fully residually free groups
- 12:20–14:30 Lunch
- 14:30–15:20 **Tim Steger**, University of Sassari
Background on fake planes
- 15:30–16:00 **Jean Lécureux**, Claude Bernard University Lyon 1
Combinatorial boundaries of buildings

- 16:10–16:40 Coffee
 16:40–17:30 **Donald Cartwright**, University of Sidney
The 50 fake projective planes
 17:40–18:00 **Bernhard Krön**, University of Vienna
Vertex cuts, ends and group splittings

July 1st (Wed.)

- 09:00–09:50 **Anna Erschler**, University of Paris-Sud 11
Boundaries of amenable groups
 10:00–10:50 **Poster Session & Coffee**
 Poster: Elisabetta Candellero, Lorenz Gilch, Motoko Kotani,
 Jeremy Macdonald, Sebastian Müller, Svetla Vassileva
 10:50–11:20 **Matthias Keller**, Universität Jena
Heat transfer to the boundary on discrete graphs
 11:30–12:00 **Erin Pearse**, University of Iowa & University of Oklahoma
Resistance analysis of infinite networks
 Afternoon Excursion

July 2nd (Thu.)

- 09:00–09:50 **James Parkinson**, University of Sydney
Random walks on p -adic groups and affine buildings
 10:00–10:30 Coffee
 10:40–11:10 **Agelos Georgakopoulos**, Graz University of Technology
Uniqueness of currents in an electrical network of finite total resistance
 11:20–11:50 **Jörg Schmeling**, Lund University
Large dimension of limit sets of Kleinian groups and transience of critical random walks
 12:00–12:20 **Riddhi Shah**, Jawaharlal Nehru University
Distal actions on locally compact groups
 12:20–14:30 Lunch
 14:30–15:20 **Vadim Kaimanovich**, University of Ottawa
Random graphs, stochastic homogenization and equivalence relations
 15:30–16:00 **Alexander Bendikov**, University of Wrocław
On a class of random walks on groups with infinite number of generators
 16:00–16:40 Coffee
 16:40–17:30 **Volodymyr Nekrashevych**, Texas A& M University
Hyperbolic duality
 17:40–18:00 **Frédéric Mathéus**, LMAM University of South-Brittany
Poisson boundary of free-by-cyclic groups

July 3rd, (Fri.)

- 09:00–09:50 **Klaus Schmidt**, University of Vienna
Sandpiles and the harmonic model
- 10:00–10:40 Coffee
- 10:40–11:10 **Tatiana Smirnova-Nagnibeda**, University of Geneva
Sandpiles and self-similar groups
- 11:20–11:50 **Markus Neuhauser**, RWTH Aachen
Further examples to a question of Atiyah
- 11:50–13:30 Lunch
- 13:30–14:00 **Michael Björklund**, Hebrew University
Sharp sunset inequalities for Bohr sets
- 14:10–15:00 **Anatoly Vershik**, St.Petersburg State University
Adjoint dynamics to a question of Atiyah

Programme of the Alp-Workshop 2009**July 4th (Sat.)**

- 09:15–09:30 Welcome
- 09:30–10:15 **Christoph Pittet**, University of Aix-Marseille 1
Return probabilities and spectral distribution of Laplace operators
- 10:20–11:05 **Peter Müller**, Ludwigs Maximilians University Munich
Ergodic properties of randomly coloured aperiodic point sets
- 11:05–11:20 Coffee
- 11:20–12:05 **Tatyana Turova**, Lund University
Asymptotic size of the largest cluster in inhomogeneous random graphs: sub-critical and critical phases
- 12:10–12:55 **Vadim Kaimanovich**, Jacobs University Bremen
Stochastic homogenization of graphs: case studies
- 12:55–14:00 Lunch
- 14:00–16:30 **Short Talks-Session & Coffee**
Wolfgang Spitzer, Bernt Metzger, Radoslaw Wojciechowski,
Matthias Keller, Sebastian Müller, Erin Pearse
- Evening **Hike and Dinner** at Mountain Cabin

July 5th (Sun.)

- 10:00–10:45 **Daniel Lenz**, Universität Jena
Amenability of Horocyclic Products of uniformly growing trees
- 10:45–11:00 Coffee
- 11:00–11:45 **Tatiana Smirnova-Nagnibeda**, Geneva University
Amenability and percolation

- 11:50–12:35 **Jörg Schmeling**, Lund University
*Random trees generated by a dynamical system
and the structure of typical orbits*
- 12:35–14:00 Lunch
- 14:00–14:45 **Franz Lehner**, Graz University of Technology
*On the Eigenspaces of Lamplighter Random Walks and
Percolation Clusters on Graphs*
- 14:50–15:55 **Poster-Session & Coffee**
Erin Pearse, Lorenz Gilch, Ecaterina Sava,
Wilfried Huss, Seon Hee Lim, Michael Matter,
Uta Freiberg, Elisabetta Candellero
- 16:00–16:45 **Peter Mörters**, University of Bath
*Simultaneous multifractal analysis of branching and
visibility measure on a Galton-Watson tree*
- 17:00–17:45 **Ivan Veselić**, TU Chemnitz
Percolation clusters on Caley graphs and their spectra
- 18:00–18:45 **Tyll Krüger, Rainer Siegmund-Schultze**, TU Berlin
Epidemic processes on networks and generalisations



A Steyr 480a “Postbus” waiting for its passengers to board before taking them to St. Kathrein am Offenegg, the venue of the Alp-Workshop 2009.

Donald I. Cartwright

Research Publications

- [1] The order completeness of some spaces of vector-valued functions. *Bull. Austral. Math. Soc.* **11** (1974), 57–61. MR50#14207.
- [2] Extensions of positive operators between Banach lattices. *Mem. Amer. Math. Soc.* **3** (1975), no. 164, iv + 48 pp. MR52#3913.
- [3] (with Lotz, Heinrich P.) Some characterizations of AM - and AL -spaces. *Math. Z.* **142** (1975), 97–103. MR52#3912.
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- [17] (with Soardi, Paolo M.) Random walks on free products, quotients and amalgams. *Nagoya Math. J.* **102** (1986), 163–180. MR#88i:60120a.
- [18] (with Soardi, Paolo M.) A local limit theorem for random walks on the cartesian product of discrete groups. *Boll. Un. Mat. Ital. (7)* **1-A** (1987), 107–115. MR#89a:60159.
- [19] Some examples of random walks on free products of discrete groups. *Annali di Matematica pura ed applicata* **106** (1988), 1–15. MR#90f:60018.
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- [48] (with Wolfgang Woess) The spectrum of the averaging operator on a network (metric graph). *Illinois J. Math.* **51** (2007), 805–830.
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Massimo A. Picardello

Research Publications

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Random Walks, Boundaries and Spectra

(Eds.) D. Lenz; F. Sobieczky, W. Woess

2011, XXVI, 325 p., Hardcover

ISBN: 978-3-0346-0243-3

A product of Springer Basel