Universität Münster

Probability and dynamics on groups

September 22–26, 2025
Münster

Organizing Committee:

Luzie Kupffer
Konstantin Recke
Eduardo Silva

living.knowledge

MM Mathematics Münster Cluster of Excellence

General information

You can find the latest information on the homepage of the conference.

Venue. The Seminarraumzentrum SRZ, Orléans-Ring 12 (cf. Map A). This is one of the two four-story buildings with corrugated metal cladding, distinguished by its square footprint. The entrance is located at the southeast corner under the bridge that connects it to the neighbouring building.
Registration: Second floor of the SRZ on Monday at 9 a.m.
Lecture room: The talks will take place in room SRZ 216/217.

Wi-Fi access. If you are part of the eduroam community, you may connect to the network "eduroam" as usual. Otherwise you can connect to the SSID "GuestOnCampus" by starting any web browser. You will automatically be redirected to the login page. Confirm the terms of use and click on "log in for free". There is 1 GB data volume available per device and day. Please note that the connection is not encrypted.

Talks. If your presentation uses slides, please send them to lkupffer@uni-muenster.de ideally by the day before your talk.

Coffee break/Lunch. We provide coffee and snacks during the coffee breaks. There are a couple of restaurants for lunch in the vicinity:

- Canteen - Mensa am Ring, Domagkstraße 61,
- Ristorante Milano (Italian), Wilhelmstraße 26 (closed on Monday),
- Il Gondoliere (Italian), Von-Esmarch-Straße 28 (closed on Monday),
- Buddha Palace (Indian), Von-Esmarch-Straße 18,
- A2 am See (German), Annette-Allee 3,
- Gustav Grün (Green Fast Food), Wilhelmstraße 1,

- Áro (Green Fast Food), Neutor 3,
- Krimphove (Bakery), Horstmarer Landweg 101.

Conference dinner. The conference dinner takes place on Wednesday at 6 p.m. at the Restaurant LUX (Domplatz 10).

Public transportation. You can check the bus schedule on the website of Stadtwerke Münster or using Google maps.

Free afternoon on Wednesday/City tour. There will be a free afternoon on Wednesday. Some suggestions: You may want to go and see the castle, its surroundings and the botanic garden which is right next to it. You can also visit a museum, e.g. the LWL Museum of Art and Cultural History, or the Picasso-Museum. You may also enjoy a walk around the lake "Aasee" or visit the City Hall, a centerpiece of European history, where the "Westphalian peace" terminating the Thirty Years' War was signed in 1648.

Questions. Please feel free to contact the organizers:
Luzie Kupffer: lkupffer@uni-muenster.de,
Konstantin Recke: konstantin.recke@maths.ox.ac.uk,
and Eduardo Silva: eduardo.silva@uni-muenster.de.

Acknowledgements

The conference is funded by the Cluster of Excellence "Mathematics Münster" as well as by the Collaborative Research Centre 1442 Geometry: Deformations and Rigidity.

Schedule

Monday, September 22

09:00-09:30	Registration
09:30-10:30	**Timothée Bénard**: Limit theorems on nilpotent Lie groups
10:30-11:00	Coffee
11:00-12:00	**Franco Severo**: Cutsets, percolation and random walks
12:00-13:30	Lunch
13:30-14:30	**Timothée Bénard**: Limit theorems on nilpotent Lie groups
14:30-15:00	Coffee
15:00-17:00	Lightning talks
17:00	Reception, open end

Tuesday, September 23

09:30-10:30	**Ádám Timár**: A short introduction to factor of iid processes
10:30-11:00	Coffee
11:00-12:00	**Timothée Bénard**: Limit theorems on nilpotent Lie groups
12:00-13:30	Lunch

13:30-14:30	**Damien Gaboriau**: Measured group theory and percolation
14:30-15:00	Coffee
15:00-16:00	**Kunal Chawla**: Non-realizability of the Poisson boundary
16:00-17:00	**Hanna Oppelmayer**: Invariant random sub-algebras

Wednesday, September 24

09:30-10:30	**Cornelia Drutu**: Connections between expander graphs and Property (T), median graphs and a-T-menability
10:30-11:00	Coffee
11:00-12:00	**Ádám Timár**: A short introduction to factor of iid processes
12:00-13:00	**Barbara Dembin**:High-intensity Voronoi percolation on manifolds
13:00-14:00	Discussion session
14:00	Free afternoon
18:00	Conference dinner (Restaurant LUX)

Thursday, September 25

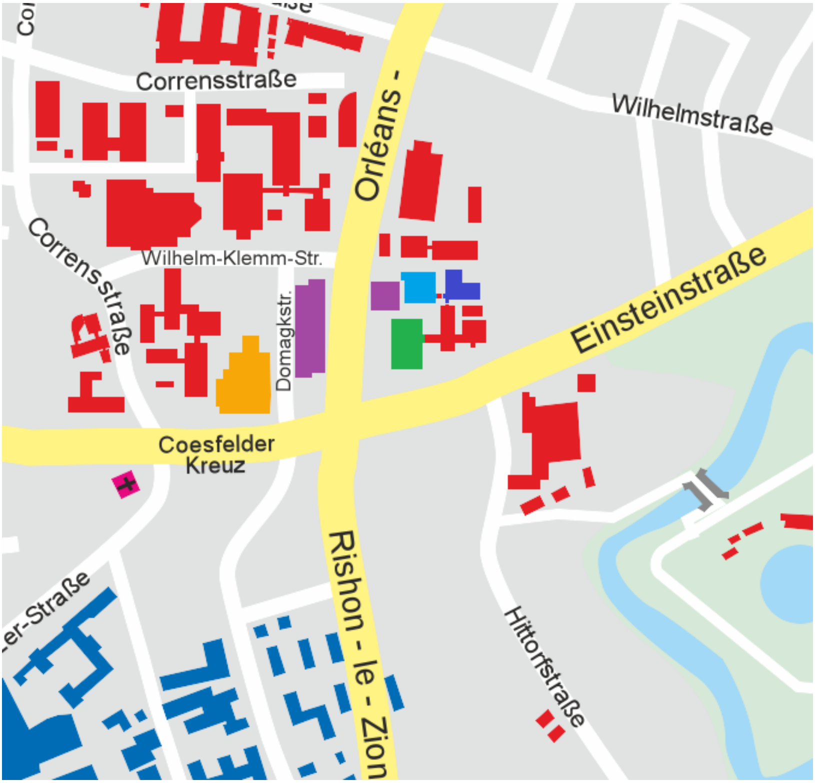
09:30-10:30	**Ádám Timár**: A short introduction to factor of iid processes
10:30-11:00	Coffee
11:00-12:00	**Inhyeok Choi**: Nonuniqueness from percolation in acylindrically hyperbolic groups
12:00-13:30	Lunch

13:30-14:30	**Damien Gaboriau**: Measured group theory and percolation
14:30-15:00	Coffee
15:00-16:00	**Corentin Correia & Vincent Dumoncel**: Isoperimetric profiles and quantitative orbit equivalence for lampshufflers
16:00-17:00	**Cornelia Drutu**: Connections between expander graphs and Property (T), median graphs and a-T-menability

Friday, September 26

09:30-10:30	**Matteo d'Achille**: Ideal Poisson–Voronoi tessellations: entrée, plat, dessert
10:30-11:00	Coffee
11:00-12:00	**Cornelia Drutu**: Connections between expander graphs and Property (T), median graphs and a-T-menability
12:00-13:00	**Damien Gaboriau**: Measured group theory and percolation
13:00	End of the school

Maps and locations



Map A: Lecture building, canteen, SRZ, MM building, parking lot.

Book of abstracts

Limit theorems on nilpotent Lie groups

Timothée Bénard (Université Sorbonne Paris Nord)

This mini-course is about random walks on simply connected nilpotent Lie groups. I will describe their limiting behavior, first at large scales via the central limit theorem, then at a fixed bounded scale via the local limit theorem. Proofs will be given in the context of the Heisenberg group.

Non-realizability of the Poisson boundary

Kunal Chawla (Princeton University)

Given a countable group G equipped with a probability measure μ, one can define a random walk on G as the Markov process whose increments are iid sampled by μ. The large-scale properties of this random walk can exhibit a plethora of exotic behaviours, relating to the algebraic and geometric structure of G.

One way of capturing the large-scale behaviour is via the Poisson boundary of (G, μ), a canonical (abstract) measure space associated with the Markov chain. This object has been studied intensely over the decades. In particular, mathematicians have found concrete 'realizations' of this measure space as topological boundaries for the group (i.e. the Gromov boundary of a hyperbolic group). It was a conjecture of Kaimanovich and Vershik whether the Poisson boundary can always be realized in this way.

I will describe the complete resolution of this conjecture in the negative. This is joint work with Joshua Frisch.

Nonuniqueness from percolation in acylindrically hyperbolic groups

Inhyeok Choi (KIAS)

Given a reasonably homogeneous graph G, what does the resulting graph look like after removing each edge independently with probability $1-p$? By choosing large or small p, It is easy to make the graph hugely disconnected or highly connected. Meanwhile, for the Cayley graphs of certain groups it is possible to tune p so that infinitely many infinite clusters arise. Benjamini and Schramm conjectured that this is a characterization of non-amenable groups. Hutchcroft indeed confirmed this conjecture for word hyperbolic groups, namely, that every Cayley graph of a word hyperbolic group has a nonuniqueness phase where infinitely many infinite clusters appear almost surely.

In this talk, I will present an answer to the conjecture for mapping class groups of surfaces and CAT(0) cubical groups. The argument is based on a connection between Hutchcroft's observation and ideas from geometric group theory. This is joint work in progress with Donggyun Seo.

Isoperimetric profiles and quantitative orbit equivalence for lampshufflers

Corentin Correia and **Vincent Dumoncel** (IMG-PRG Paris)

Two groups G and H are orbit equivalent if there exist two free probability measure-preserving G- and H-actions on a standard probability space, having the same orbits. Since this theory is trivial among infinite amenable groups, we need to strengthen its definition.

A well-known invariant, called the isoperimetric profile, provides obstructions to quantitative strengthenings of orbit equivalence. It also serves as a measurement of amenability. The more a group is amenable, the faster its profile tends to infinity.

Quantitative orbit equivalence thus quantifies, in some sense, how much the geometries of amenable non-quasi-isometric groups differ.

Our work focuses on a class of groups which look like lamplighters: lampshuffler groups. Our main results are a computation of their isoperimetric profiles and a classification up to quantitative orbit equivalence of lampshufflers over free abelian groups.

Ideal Poisson–Voronoi tessellations: entrée, plat, dessert

Matteo d'Achille (Institut Éllie Cartan de Lorraine)

I will introduce ideal Poisson–Voronoi tessellations (IPVTs), which may arise as low-intensity limits of Poisson–Voronoi tessellations. Starting with the IPVT of d-dimensional hyperbolic space, I will describe key features of this new limit object in other settings as well, such as Cartesian products of hyperbolic planes and horocyclic products of regular trees (also known as Diestel–Leader graphs). Finally, I will discuss a surprising application to Bernoulli–Voronoi percolation.

Based on a joint paper with Nicolas Curien, Nathanaël Enriquez, Russell Lyons, and Meltem Ünel (Ann. Probab.), on 2412.00822, and on works in preparation with Ali Khezeli, as well as with Jan Grebik, Ali Khezeli, Konstantin Recke, and Amanda Wilkens.

High-intensity Voronoi percolation on manifolds

Barbara Dembin (Université de Strasbourg)

Consider a d-dimensional complete Riemannian manifolds (for simplicity one can just think of $\mathbb{H}^d$ for $d \geq 2$). In this setting, Voronoi cells are constructed from a homogeneous Poisson point process of intensity λ, and each cell is independently colored white with probability p and black with probability $1-p$. We focus on the percolation properties of the resulting random coloring as the intensity λ goes to infinity. Our main result shows that, under mild geometric assumptions on the manifold M, both the critical percolation threshold $p_c(M, \lambda)$ for the emergence of an unbounded white cluster and the uniqueness threshold $p_u(M, \lambda)$ converge to the Euclidean critical threshold $p_c(\mathbb{R}^d)$ in the high-intensity limit $\lambda \to \infty$.

Joint work with Tillmann Bühler, Ritvik Radhakrishnan and Franco Severo.

TBA

Cornelia Drutu (University of Oxford)

This mini-course will explore how two opposite properties of families of finite graphs closely connect with two key properties of infinite groups. Thus, expander graphs (graphs that are hard to disconnect, representing robust networks) are closely related with Kazhdan's property (T), both as a way to construct expanders and as a way to construct groups with Property (T) using expanders. At the opposite end, median graphs (economic networks, relatively easy to disconnect) are closely related with the property of a-T-menability (also called the Haagerup property).

Measured group theory and percolation

Damien Gaboriau (ENS Lyons)

I plan to present some foundational aspects of orbit equivalence theory and explore its rich, bidirectional interplay with Bernoulli percolation on Cayley graphs, with a focus beyond $\mathbb{Z}^d$. I will discuss how key results and techniques from each field have deeply influenced the other. This should include how ergodic-theoretic methods and orbit equivalence provide some tools to analyze percolation thresholds (p_c, p_u) and phase transitions on Cayley graphs. We should also allude to applications of percolation theory to the von Neumann problem and cost theory.

This mutual reinforcement highlights profound connections between these areas, demonstrating how they continuously inspire and advance each other.

Invariant random sub-algebras

Hanna Oppelmayer (Université Grenoble Alpes)

The notion of invariant random subgroups (IRS) is a fruitful, well-studied concept in dynamics on groups. I will explain how to extend this notion to group von Neumann algebras LG, where G is a discrete countable group. We call it invariant random sub-von Neumann algebra (IRA). As an application, I will provide a result concerning amenable IRAs, which generalises a theorem of Bader-Duchesne-Lécureux about amenable IRSs. This is joint work with Tattwamasi Amrutam and Yair Hartman.

Cutsets, percolation and random walk

Franco Severo (Université Claude Bernard Lyon 1)

Which graphs G admit a percolating phase (i.e. $p_c(G) < 1$)? This seemingly simple question is one of the most fundamental ones in percolation theory. A famous argument of Peierls implies that if the number of minimal cutsets of size n from a vertex to infinity in the graph grows at most exponentially in n, then $p_c(G) < 1$. Our first theorem establishes the converse of this statement. This implies, for instance, that if a (uniformly) percolating phase exists, then a "strongly percolating" one also does. In a second theorem, we show that if the simple random walk on the graph is uniformly transient, then the number of minimal cutsets is bounded exponentially (and in particular $p_c < 1$). Both proofs rely on a probabilistic method that uses a random set to generate a random minimal cutset whose probability of taking any given value is lower bounded exponentially on its size.

Joint work with Philip Easo and Vincent Tassion.

A short introduction to factor of iid processes

Ádám Timár (University of Iceland & Rényi Institute)

Consider a group with a finite generating set and its Cayley graph G. A natural way to generate a random process on G is to assign i.i.d. uniform $[0,1]$-labels to the vertices, and then apply a local rule that produces new labels for each vertex (or edge). Such a rule is called a factor of i.i.d. Formally, a map $\phi : [0,1]^{V(G)} \longrightarrow A^{V(G)}$ is a factor of i.i.d. if it is measurable in the product topology and equivariant with respect to the automorphism group of G. Whether a process arises as a factor of i.i.d. is motivated from two directions.

Combinatorial/optimization problems. Factor of i.i.d. analogues of tasks such as finding independent sets, matchings, or colorings can be useful for the corresponding finite-graph problems and are interesting in their own right. For example: can the maximum density of an Aut(G)-invariant random independent set be attained as a factor of i.i.d.?

Probabilistic models. Is the Ising model or the Uniform Spanning Forest a factor of i.i.d.? More generally, which random processes can be constructed this way? These questions connect to simulations and extend the ergodic-theoretical notion of Bernoulli processes.

Factor of i.i.d. constructions are also of interest in distributed computing and descriptive combinatorics, all of which study functions defined by local rules.

This minicourse will survey some of the main ideas and highlights of this developing theory. No background beyond the undergraduate level will be assumed.