

IST Austria Summer School in Probability and Mathematical Physics

**IST Austria, Klosterneuburg
June 4-8, 2018**



**Conference organizers:
Prof. László Erdős, Prof. Jan Maas, Prof. Robert Seiringer**



IST Austria Summer School in Probability and Mathematical Physics

Table of Contents

IST Austria Summer School in Probability and Mathematical Physics	0
About IST Austria.....	2
Campus Map	3
Program.....	4
Abstracts	6
Transport to and from Klosterneuburg / Vienna Heiligenstadt	9
Bus Schedule to and from IST (IST Shuttle #142, Public Bus #239).....	12
Ticket for IST Shuttle #142 - Invitation	13
Transport in Vienna	14
Taxis.....	14
Around IST Austria.....	15
Registration for other events during summer school	15
Hotels in Klosterneuburg	16
Restaurants in Klosterneuburg.....	17



IST Austria Summer School in Probability and Mathematical Physics

About IST Austria

The Institute of Science and Technology Austria (IST Austria) is an international, multidisciplinary research institution dedicated to basic research in the natural, computer and mathematical sciences. The Institute is located in the city of Klosterneuburg, 18 km from the center of Vienna. As a PhD granting institution, the graduate school at IST Austria educates doctoral students from diverse and international backgrounds with the aim of cultivating world-class research scientists. IST Austria was established jointly by the federal government of Austria and the provincial government of Lower Austria and inaugurated in 2009.

Currently, nearly 600 employees from about 60 countries work at IST Austria. At present, the faculty of the institute consists of 49 professors. Following the implementation of the ambitious development plan, about 90 research groups will be working at IST Austria in a highly modern environment by 2026. To foster a creative and interdisciplinary scientific atmosphere, separating organizational structures, such as departments, are avoided at IST Austria. The scientists are organized into independent research groups, each headed by a Professor or a tenure-track Assistant Professor. The decision to promote an Assistant Professor to Professor with a permanent contract is based entirely on an evaluation of the scientific achievements of the Assistant Professor by international experts. Research excellence and promise are the exclusive hiring criteria for all scientists at IST Austria - from doctoral students to professors. The Institute chooses which fields of science to enter based solely on the availability of outstanding individuals. It will pursue a direction of research only if it can compete with the best in the world.

Contact Information:

Institute of Science and Technology Austria (IST Austria)

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IST Austria Summer School in Probability and Mathematical Physics

Campus Map

The conference will take place at the Raiffeisen Lecture Hall (RLH, Building 02) at IST Austria.



01 Central Building	05 Preclinical Facility Building	21 Lab and Office Building West	28 Fire Station
Science Offices Guesthouse Oberbank Ballroom Mondi Seminar Center Pub	06 Lab Building East	22 Cafeteria	36 Church
02 Raiffeisen Lecture Hall	11 Facility Management Security	27 Kindergarten	A1 Art/Brut Center gugging
03 voestalpine Building	12 Heating Plant	31-35 Apartments	A2 Haus der Künstler
Administration	13 Miba Machine Shop	41 Tennis Courts	
04 Bertalanffy Foundation Building	16 Power Control	42 Soccer Field	



IST Austria Summer School in Probability and Mathematical Physics

Program

Monday June 4		
9:30 - 10:45	Martin Hairer	A BPHZ theorem for stochastic PDEs –part I
10:45 - 11:30	Coffee Break	
11:30 - 12:45	Jason Miller	The Gaussian free field and Liouville quantum gravity -part I
12:45 - 14:45	Lunch	
14:45 - 15:30	Vincent Tassion	No exceptional word in 3d percolation
15:30 - 16:00	Coffee Break	
16:00 - 16:45	Ajay Chandra	Stochastic non-Abelian Yang-Mills heat flow

Tuesday June 5		
9:30 - 10:45	Jason Miller	The Gaussian free field and Liouville quantum gravity II
10:45 - 11:30	Coffee Break	
11:30 - 12:45	Martin Hairer	A BPHZ theorem for stochastic PDEs-part II
12:45 - 14:45	Lunch	
14:45 - 15:30	Ewain Gwynne	A mating-of-trees approach for graph distances and random walk on random planar maps
15:30 - 16:00	Coffee Break	
16:00 - 16:45	Ioan Manolescu	First order phase transition for the Random Cluster model with $q > 4$

Wednesday June 6		
9:30 - 10:45	Hugo Duminil-Copin	Sharp threshold phenomena via randomized algorithms -part I



IST Austria Summer School in Probability and Mathematical Physics

Wednesday June 6		
10:45 - 11:30	Coffee Break	
11:30 - 12:45	Martin Hairer	A BPHZ theorem for stochastic PDEs –part III
12:45 - 14:45	Lunch	
14:45 - 16:00	Hugo Duminil-Copin	Sharp threshold phenomena via randomized algorithms -part II
16:00 - 16:30	Coffee Break	
18:30 - 19:30	Martin Hairer	IST/ÖAW Lecture (in Vienna)

Thursday June 7		
9:30 - 10:45	Jason Miller	The Gaussian free field and Liouville quantum gravity-part III
10:45 - 11:30	Coffee Break	
11:30 - 12:45	Hugo Duminil-Copin	Sharp threshold phenomena via randomized algorithms –part III
12:45 - 14:45	Lunch	
14:45 - 16:00	Martin Hairer	A BPHZ theorem for stochastic PDEs –part IV
16:00 - ...	Excursion & Dinner	

Friday June 8		
9:30 - 10:45	Hugo Duminil-Copin	Sharp threshold phenomena via randomized algorithms-part IV
10:45 - 11:30	Coffee Break	
11:30 - 12:45	Jason Miller	The Gaussian free field and Liouville quantum gravity –part IV
12:45 - 14:45	Lunch	



IST Austria Summer School in Probability and Mathematical Physics

Abstracts

Courses

Hugo Duminil Copin (IHÉS & Université de Genève)

Sharp threshold phenomena via randomized algorithms

In these lectures, we will present different techniques developed over the past few years, enabling mathematicians to prove that correlations decay exponentially fast in the disordered phase. We will focus on a few classical models of statistical physics, including Bernoulli percolation, the Ising model and the Potts models.

Martin Hairer (Imperial College London)

A BPHZ theorem for stochastic PDEs

Jason Miller (University of Cambridge)

The Gaussian free field and Liouville quantum gravity

Lectures

Ajay Chandra (Imperial College London)

Stochastic non-Abelian Yang-Mills heat flow

I will start by describing how a probabilist can think of the problem of constructing a Yang-Mills quantum field theory and how one approach to this problem involves working with singular SPDE. I will then present some new results, obtained in an ongoing joint work with Martin Hairer and Hao Shen, regarding local existence and gauge covariance for a singular SPDE that should correspond to a non-Abelian Yang-Mills quantum field theory in two space dimensions.



IST Austria Summer School in Probability and Mathematical Physics

Ewain Gwynne (MIT)

A mating-of-trees approach for graph distances and random walk on random planar maps

We discuss a general approach for analyzing certain random planar maps — including the uniform infinite planar triangulation (UIPT) and random planar maps sampled with probability proportional to the number of spanning trees, bipolar orientations, or Schnyder woods they admit. Our approach is based on a strong coupling of each of the maps under consideration with SLE-decorated Liouville quantum gravity (LQG), which arises from mating-of-trees theory. This coupling allows us to deduce estimates for random planar maps from estimates for SLE and LQG.

Using this approach, we obtain several results for graph distances in natural non-uniform random planar maps which in particular suggest new upper and lower bounds for the Hausdorff dimension of LQG. We also prove that random walk on the UIPT typically travels graph distance $n^{1/4 + o(1)}$ in n units of time and that the spectral dimension of a class of random planar maps (including the UIPT) is a.s. equal to 2 — i.e., the return probability to the starting point after n steps is $n^{-1+o(1)}$.

Based on joint works with Jian Ding, Nina Holden, Tom Hutchcroft, Jason Miller, and Xin Sun.

Ioan Manolescu (University of Fribourg)

First order phase transition for the Random Cluster model with $q > 4$

This talk aims to prove that the phase transition of the planar random cluster model (and that of the associated Potts model) is discontinuous when $q > 4$. The result is obtained by computing rigorously the correlation length of the critical RCM using a correspondence with the six vertex model. The latter may be expressed using the transfer matrix formalism; the Perron-Frobenius eigenvalues of the diagonal blocks of the transfer matrix may then be computed using the Bethe ansatz.

Based on joint work with: Hugo Duminil-Copin, Maxime Gagnebin, Matan Harel and Vincent Tassion.



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Vincent Tassion (ETH Zurich)

No exceptional word in 3d percolation

We present some new results concerning the following problem, raised by Benjamini and Kesten (1995). Consider a site percolation configuration on Z^3 at parameter $1/2$. Each vertex receives

independently the value 1 , and 0 with equal probability. Which words (i.e. infinite sequences of 0 's and 1 's) can be read when following a self-avoiding path in the graph Z^3 ?

Based on a joint work with P. Nolin and A. Teixeira.



IST Austria Summer School in Probability and Mathematical Physics

Transport to and from Klosterneuburg / Vienna Heiligenstadt

- **Conference Shuttle for everyone. This bus is a double decker and has a sign „IST Austria Summer School“ on the window**

(Wien Heiligenstadt (End of Subway line U4 –Niedermarkt Klosterneuburg - IST Austria):

Pick up in the mornings:

08:30 Wien Heiligenstadt

Aproximately 08:40-08:45 Niedermarkt Klosterneuburg (In front of Hotel Schrankenhof, Hotel Anker)

09:00 IST Austria

Pick up in the evenings:

Monday & Tuesday pick up at IST Austria at 17:00

On Wednesday, there is a shuttle from IST Austria to Vienna for IST Austria- ÖAW Lecture at 17:30

On Thursday there is an afternoon program planned (Visit Klosterneuburg Abbey)

ON Friday, pick up at IST Austria at 15:00

- **IST Shuttle (#Bus 142)** stops at IST Austria, Klosterneuburg Stadtplatz, and Heiligenstadt (Vienna U4 subway). Free for participants when showing the bus invitation below.

You can use this in emergency cases (if you miss the conference shuttle for example).

Please note that the stop in Klosterneuburg is not at Niedermarkt (where the conference bus stops, but at Stadtplatz)

- **Public Bus #239** (note: check direction, it needs to say MARIA GUGGING if going to IST Austria!), €2,20 one way, payable on the bus in cash.

This bus stops at Bahnhof Weidling and can be used by guests who are staying at Hotel Höhenstrasse to get directly to IST Austria or to the station Niedermarkt where the Conference bus stops.

It also stops at Niedermarkt and Stadtplatz in Klosterneuburg.



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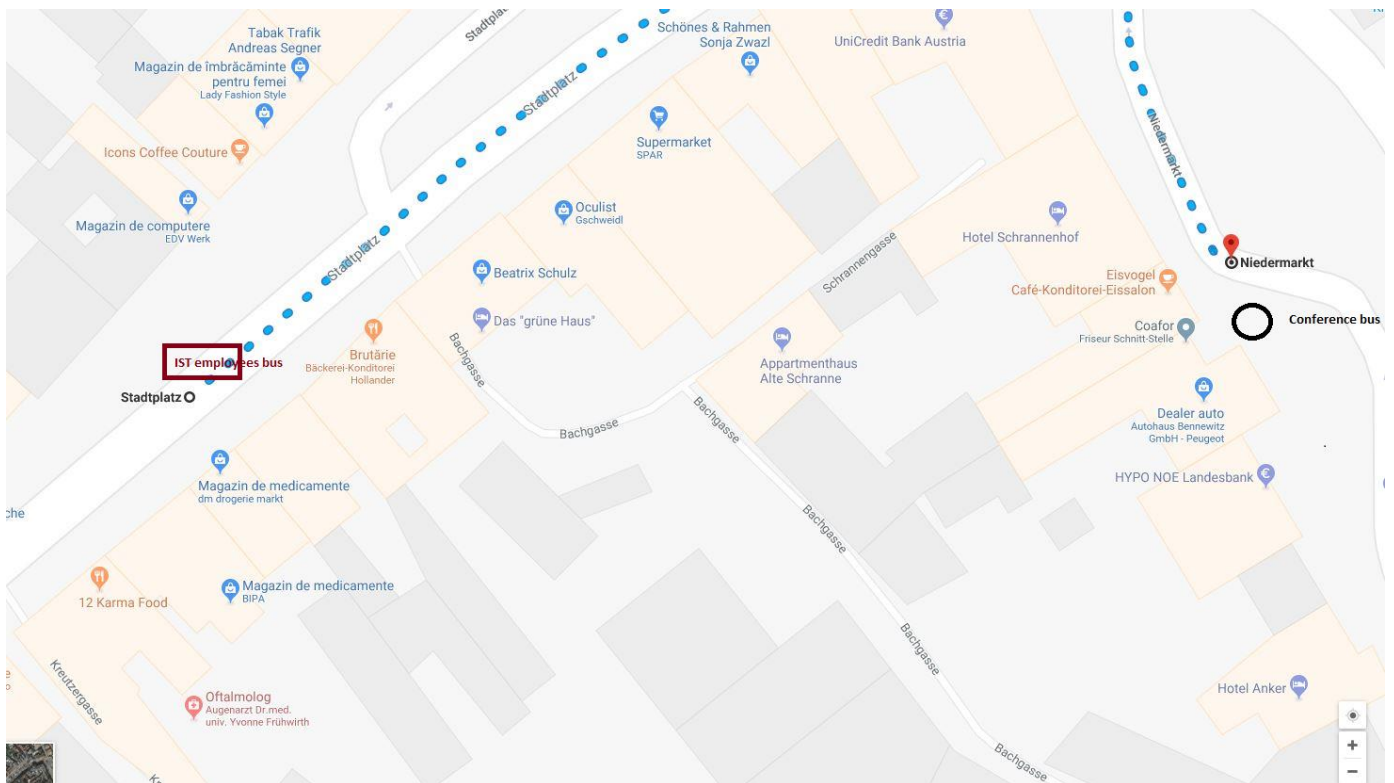
Orientation map in Klosterneuburg

Conference Bus stops at Niedermarkt (Black Circle)

If you miss the bus, you can use the IST Austria Employee Shuttle bus from Stadtplatz (red rectangle)

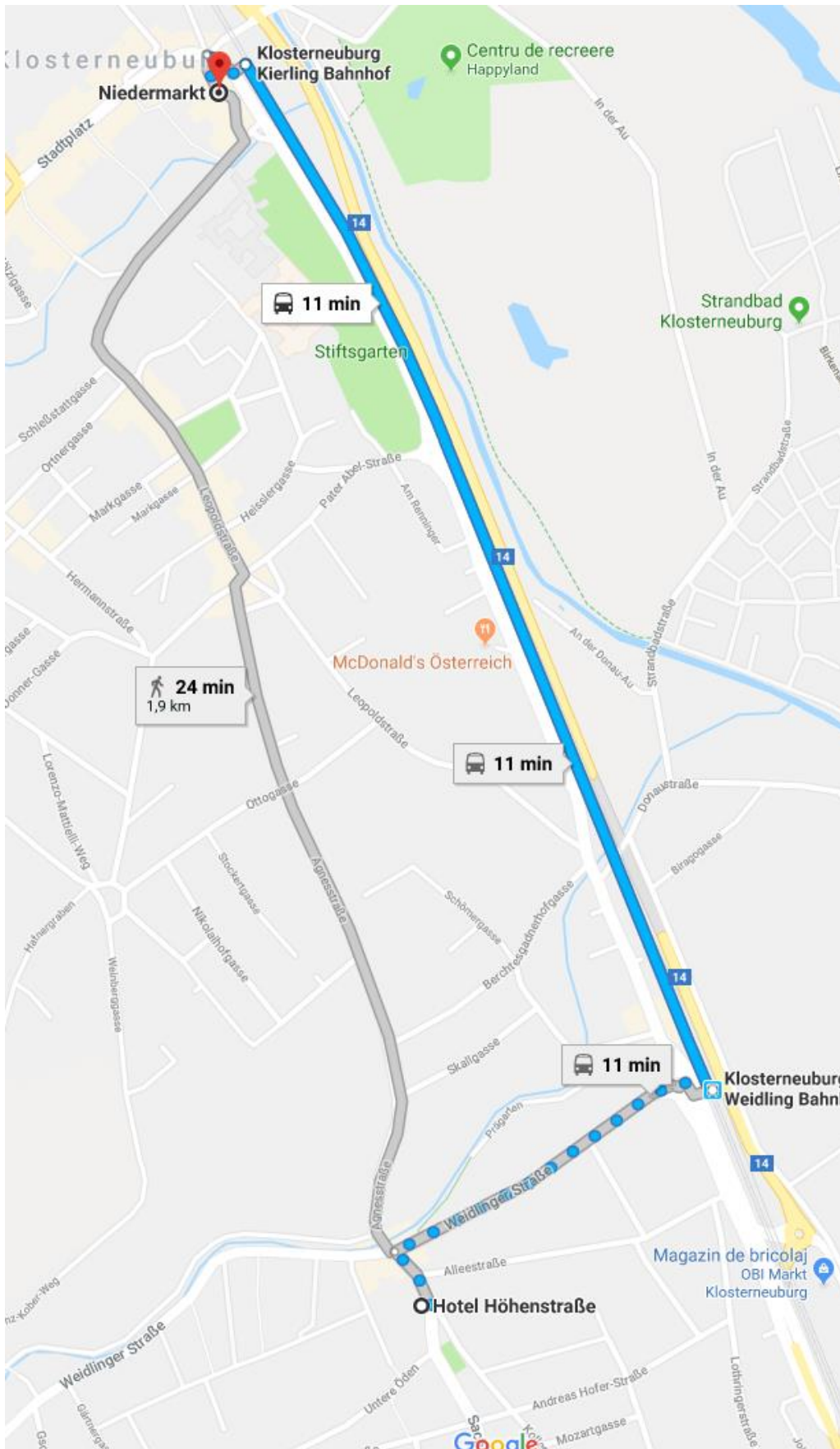
If you stay at Hotel Höhenstraße in Klosterneuburg, you will have to either walk longer (2 km) to reach Niedermarkt bus station, take the train S40 for one stop (from Bahnhof Weidling and get off at Bahnhof Kierling), or take the Bus 239 (it stops in front of Bahnhof Weidling).

The bus 239 stops at Niedermarkt- and you can take the conference shuttle from there – and **some of the buses** (with the mention “Maria Gugging” on them) go to IST Austria.





IST Austria Summer School in Probability and Mathematical Physics





IST Austria Summer School in Probability and Mathematical Physics

Bus Schedule to and from IST (IST Shuttle #142, Public Bus #239)

MONDAY - FRIDAY (except Austrian bank holiday)

Table with columns for Bus line (IST 142, 239, 341), Point of departure/arrival, and times for various routes including Heiligenstadt/Vienna and Klosterneuburg.

Table with columns for Bus line (IST 142, 239), Point of departure/arrival, and times for routes including Heiligenstadt/Vienna and Klosterneuburg, with a 'Last 239' column.

Table with columns for Bus line (IST 142, 239, 341), Point of departure/arrival, and times for routes including Maria Gugging/IST Austria and Heiligenstadt/Vienna.

Table with columns for Bus line (IST 142, 239, 341), Point of departure/arrival, and times for routes including Maria Gugging/IST Austria and Heiligenstadt/Vienna, with a 'Last 239' column.

SATURDAY (except Austrian bank holidays)

Table with columns for Bus line (IST 142, 239), Point of departure/arrival, and times for routes including Heiligenstadt/Vienna and Klosterneuburg.

Table with columns for Bus line (IST 142, 239, 341), Point of departure/arrival, and times for routes including Maria Gugging/IST Austria and Heiligenstadt/Vienna, with a 'Last 239' column.

SUNDAY & AUSTRIAN BANK HOLIDAYS

Table with columns for Bus line (IST 142, 239), Point of departure/arrival, and times for routes including Heiligenstadt/Vienna and Klosterneuburg.

Table with columns for Bus line (IST 142, 239), Point of departure/arrival, and times for routes including Maria Gugging/IST Austria and Heiligenstadt/Vienna, with a 'Last 239' column.

IST AUSTRIA SHUTTLE BUS PRICES (valid as of July 06, 2016)

Table showing IST Austria shuttle bus prices for regular passengers, with columns for route, one-way ticket for adults, and one-way ticket for children.



IST Austria Summer School in Probability and Mathematical Physics

Ticket for IST Shuttle #142 - Invitation

The IST Austria Summer School in Probability and Mathematical Physics will be held from June 4-8, , 2018 at IST Austria in Klosterneuburg, Austria. The conference is organized by IST Austria (Prof. Erdoes, Prof. Maas and Prof. Seiringer)

IST Shuttle (Public Bus #142) stops at IST Austria, Klosterneuburg Stadtplatz, and Heiligenstadt (Vienna U4 subway).



This invitation is valid as a ticket for the IST Shuttle from and to Heiligenstadt Station. The IST Shuttle bus is marked IST Shuttle (#142) and has the Institute Logo printed on the side.



IST Austria Summer School in Probability and Mathematical Physics

Transport in Vienna

Vienna has efficient public transport consisting of subways (U-Bahn), trams (Straßenbahn) and busses. A single ticket is valid on all means of transport except for the airport (CAT) train. Tickets are bought at the ticket machines located in every subway station and need to be validated by stamping them at the small blue boxes at the entry to the subway platform or inside the trams and busses respectively. Check www.wienerlinien.at for further information.

Getting to the airport

For going to the airport, you can either take a cab from IST Austria (see “Taxis”, below; approx. 45 minutes-1 hour), or go by public transport (shuttle bus or public bus) to U4 Heiligenstadt, take the U4 line to the stop Landstraße-Wien Mitte, and the direct CAT airport train to the airport (altogether approx. 1 ½ hours)

Taxis

For a cab from IST Austria to Heiligenstadt (U4 stop), Vienna downtown or the airport (best to have cash ready, an ATM is located in the lobby of the Central Building on IST Austria’s campus):

- **Taxi Danzinger** (www.taxi-danzinger.at, +43 2243 202 20, +43 676 666 50 70, about 55 EUR to the airport)
- **Taxi Glück** (www.konlechner.at/glueck, +43 2243 361 11, +43 664 224 88 20, about 55 EUR to the airport)

You can take a cab from the airport directly to IST Austria, but be sure to have the full address of the Institute on hand (IST Austria, Am Campus 1, 3400 Klosterneuburg). If their GPS does not have this address yet, try Hauptstraße 2, 3400 Maria Gugging.



IST Austria Summer School in Probability and Mathematical Physics

Around IST Austria

The area around the IST Austria offers a variety of recreational activities. You can walk along the Danube, or hike through the forests of the Buchberg and reward yourself with an unforgettable panoramic view of Klosterneuburg.

- BILLA supermarket, open Mon-Fri 7:15-19:30, Sat 7:15-18:00.
- Museum Gugging www.gugging.org, 5 minute walk from IST Austria
- Stift Klosterneuburg (Klosterneuburg monastery) www.stift-klosterneuburg.at

Registration for other events during summer school

We are happy to have you on campus and we are trying to make your stay as scientifically rich and interesting as possible.

There are two other very interesting lectures taking place during the summer school:

- Monday, June 4 at 6:00 p.m at Raiffeisen Lecture Hall (IST Austria)
IST Lecture- Ben Feringa (University of Groningen)“The art of building small”
- Wednesday, June 6 at 6:30 p.m.at Austrian Academy of Sciences
(Dr. Ignaz Seipel-Platz 2, 1010 Vienna)- Shuttle bus leaves at 5:30 pm
ÖAW-IST Lecture Martin Hairer(Imperial College London)
- Thursday, June 7 at 4:30 p.m.at Klosterneuburg Monastery
Gudied tour of the monastery (in English), followed by dinner at Stiftskeller Restaurant at 6:00 pm (Albrechtsberggasse 1, Klosterneuburg)

If you want join these events please inform our team at the registration desk.

Wifi@ IST Austria

The public wireless (“public-wlan”) is an open wireless with no encryption nor security. It grants access to internet only.



IST Austria Summer School in Probability and Mathematical Physics

Hotels in Klosterneuburg

Hotel Schrannenhof

3400 Klosterneuburg, Niedermarkt 17-19

+43 2243 32072

info@schrannenhof.at

www.schrannenhof.at

Hotel Restaurant Anker

3400 Klosterneuburg, Niedermarkt 5

+43 2243 32134

info@hotel-anker.at

www.hotel-anker.at

Frühstückspension Alte Mühle

3400 Klosterneuburg, Mühlengasse 36

+43 2243 37788

info@hotel-altemuehle.at

www.hotel-altemuehle.at

Bürgerhaus Salmeyer

3400 Klosterneuburg, Stadtplatz 17

+43 2243 32146

info@buergerhaus-salmeyer.at

www.buergerhaus-salmeyer.at

Hotel Höhenstraße

3400 Klosterneuburg, Kollersteig 6

+43 2243 32191

info@hotel-hoehenstrasse.at



IST Austria Summer School in Probability and Mathematical Physics

Restaurants in Klosterneuburg

- **Der Waldhof**
(Traditional Austrian cuisine)
10 am – 10 pm, closed on Mondays
3400 Maria Gugging, Hauptstraße 132
Phone: +43 2243 87490
www.der-waldhof.at
- **Trattoria Castel Nuovo**
(Italian restaurant)
11:30 am- 11 pm, closed on Mondays
3400 Klosterneuburg, Weidlinger Straße 39
Phone: +43 2243 20610
www.castelnuovo.at
- **Poseidon**
(Greek restaurant)
Open every day, 11 am – 3pm, 5pm – midnight
3400 Klosterneuburg, Kierlingersraße 47a
Phone: +43 2243 33634
www.poseidon-klosterneuburg.at



IST Austria Summer School in Probability and Mathematical Physics

The [Institute of Science and Technology Austria \(IST Austria\)](#) organizes a Summer School on hot topics of current research in mathematical physics and probability. The event is aimed at a broad audience of researchers in these fields, particularly focusing on PhD students and postdocs.

The summer school takes place at the campus of IST Austria, a young international institute dedicated to basic research and graduate education in the natural and mathematical sciences. The institute is located in Klosterneuburg on the outskirts of Vienna.

Lecturers:

- [Hugo Duminil-Copin](#) (IHES): Sharp threshold phenomena via randomized algorithms
- [Martin Hairer](#) (Imperial College London): A BPHZ theorem for stochastic PDEs
- [Jason Miller](#) (University of Cambridge): The Gaussian free field and Liouville quantum gravity

In addition there will be talks by Ajay Chandra (Imperial College London), [Ewain Gwynne](#) (MIT), [Ioan Manolescu](#) (University of Fribourg), and [Vincent Tassion](#) (ETH Zurich).

Date: June 4-8, 2018

Organizers: László Erdős, Jan Maas, Robert Seiringer

The projects have received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 338804, 694227, and 716117.



European Research Council
Established by the European Commission



IST Austria Summer School in Probability and Mathematical Physics

Contact Information

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For general administrative questions:

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Dana.domnisor@ist.ac.at

For conference bus itinerary:

Giovanni Alessandro Zanco (Maas Group), Mobile: +43 681 2033 7960
Thomas Moser (Seiringer Group), Mobile: +43 699 1196 1463

Giovanni and Thomas will accompany the conference bus on the first days. If you do not find the bus station or the bus, you can call them to guide you.