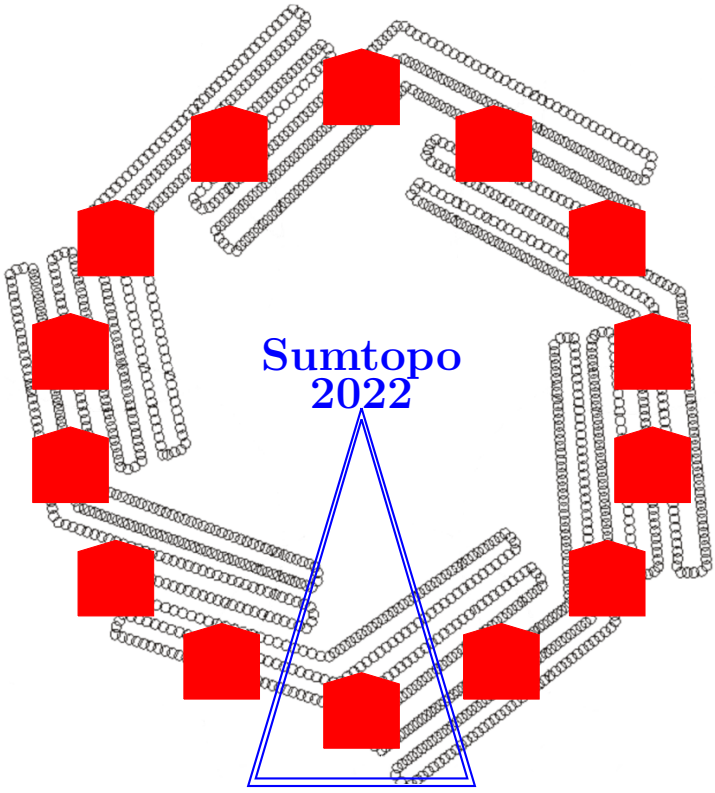
36th Summer Topology Conference
Vienna 18-22 July 2022



Dear Participants

Welcome to the 36th Summer Topology conference, re-emerging in Vienna from corona-lockdowns. The pandemic is not over, and we are aware that some people will be unable or uncomfortable travelling, and hence some of the talks will be online only. Most talks are on site, and in general will be recorded and made accessible to participants on the website where you found this booklet.

All talks and the welcome party will take place in the mathematics department at Oskar Morgensternplatz 1 (OMG1) in Vienna, see maps further in this booklet. The conference dinner will be at two separate Heuriger, at the hills north of Vienna, but in easy reach of public transport (see the information further in this booklet).

The closest stops for public transportation are U4 Roßauerlände, U4 Schottenring and D-tram Schlickgasse. This D-tram is probably the most touristic tram of Vienna, as it passes many sites of interest, from the new Main Station Vienna via Belverdere, Wiener Konzerthaus, Schwarzenberg Palace, Opera House, Hofburg, Parliament (still under renovation), Burg Theater, Town Hall, the University's Main Building, **the Gödel Institute of Logic & Mathematics Department**, the Hundertwasser-designed heating plant all the way to Heiligerstadt (Beethoven's Heilgerstädter testament). In short, we hope you take the opportunity to see the beautiful and melodious scenes of the city, but at the same time, have fruitful maths discussions and enjoy inspiring talks.

We hope you have a wonderful conference and an enjoyable stay in Vienna.

Organizing Committee

Henk Bruin
Jernej Činč
Vera Fischer
Olga Lukina

Some practicalities

Registration will be on Monday, July 18th, morning (8:00 to 12:00) at the first floor on either side of the main stairwell of the Faculty of Mathematics (Oskar-Morgenstern-Platz 1). The lectures are all on the second floor. Late registration is possible in Seminar Room 14 (also 2nd floor). (Note that in Austria the count of floors in buildings starts from 0, i.e. the ground floor, the first floor, etc. When you enter the Faculty of Mathematics building from the street, you are in the ground floor).

You will receive your welcome pack with practical information, the conference program, and a confirmation of attendance and payment. This confirmation will contain your name, the amount you paid for the registration fee and the title of your talk. We ask the participants that require special information on the confirmations (e.g. the affiliation or the tax number of the university) to contact us directly through sumtopo2022.mathematik@univie.ac.at and state explicitly what needs to be written on required confirmations.

Social dinner will be held on Wednesday evening in a Heuriger. You will find more information about that in your welcome pack.

Please refer to the conference website for the information on how to get to the Faculty of Mathematics, or from the airport to the city of Vienna etc. For other assistance requests and the like, please send us an email.

Talks finish (well) before 19:00 and, with the exception of Monday (when there is the welcome party in the Skylounge at the 12th floor), we will have to be out the building by 19:00. Please comply and help us to keep a good relation with the security personnel.

Covid-19 rules in Vienna: **FPP2** face masks are obligatory in the public transport, hospitals and pharmacies. Such masks are available for purchase in most supermarkets and pharmacies. If you arrive via the Vienna International Airport, we recommend you buy FPP2 masks already at the airport. Also inside the conference venue, wearing a FPP2 mask is required whenever one is not consuming food or drink or giving a lecture.

1 Program

	Geometric	Continuum	Topological	Tiling	Foliation	Set-Theoretic	Functional
	Group Theo	Theory	Dynamics	Spaces	Theory	Topology	Analysis
Monday	Monday	Monday	Monday	Monday	Monday	Monday	Monday
9-10	Hensel, HS13						Plebanek, HS14
Coffee-break							
10:30-12:30	HS13	HS16			HS17		HS14
Lunch							
14:30-15:30							Shelah, HS14
Coffee-break							
16:00-17:30			HS16		HS17	HS14	
17:30-18:30							Bergfalk, HS14
Welcome							
Party							
Tuesday	Tuesday	Tuesday	Tuesday	Tuesday	Tuesday	Tuesday	Tuesday
9-10			Ye, HS13	HS11			
Coffee-break							
10:30-12:30	HS16		HS13	HS11			HS17
Lunch							
14:30-15:30		HS13		HS11		HS17	
Coffee-break							
16:00-17:30	HS16	HS13		HS11		HS17	
17:30-18:30						HS17	
Wednesday	Wednesday	Wednesday	Wednesday	Wednesday	Wednesday	Wednesday	Wednesday
9-10		Kwiatkowska HS11		Sadun HS13			
Coffee-break							
10:30-12:30	HS16	HS11		HS13		HS17	
Lunch							
Conference							
Dinner							
Thursday	Thursday	Thursday	Thursday	Thursday	Thursday	Thursday	Thursday
9-10					Nariman, HS1	Aurichi HS13	
Coffee-break							
10:30-12:30		HS17		HS11	HS16	HS13	
Lunch							
14:30-15:30	HS11		HS16		HS17		HS13
Coffee-break							
16:00-17:30			HS16		HS17		HS13
Friday	Friday	Friday	Friday	Friday	Friday	Friday	Friday
9-10			Boyland, HS14				
Coffee-break							
10:30-12:30			HS14		HS13	HS16	
Lunch							

Plenary Speakers

Jeff Bergfalk 4.1	Barcelona (Recipient of the 2022	Monday 17:30 Mary Rudin Award)	HS14
Phil Boyland 4.2	Univ. of Florida at Gainesville	Friday 9:00	HS14
Saharon Shelah 4.3	Hebrew University	Monday 14:30	HS14

Semiplenary Speakers

Leandro Aurichi 4.78	São Paulo	ST	Thursday 9:00	HS13
Aleksandra Kwiatkowska 4.4	Münster/Wrocław	CT	Wednesday 9:00	HS11
Sebastian Hensel 4.58	Munich	GGT	Monday 9:00	HS13
Sam Nariman 4.40	Purdue University	FT	Thursday 9:00	HS11
Grzegorz Plebanek 4.23	Wrocław	FA	Monday 9:00	HS14
Lorenzo Sadun 4.117	Austin TX	TS	Wednesday 9:00	HS13
Xiangdong Ye 4.100	Hefei University	TD	Tuesday 9:00	HS13 (online)

Special events

Registration	Ground floor (main stairwell)	Monday from 8:00
Welcome Party	Skylounge (12th floor)	Monday 19:00
Conference Dinner A	Heuriger Wolff	Wednesday 18:30
Conference Dinner B	Heuriger Friseurmüller	Wednesday 18:30

2 Special sessions

2.1 Continuum Theory (CT)

Organisers: Ana Anušić, Jan Boroński

Speaker	Time	Place
Alexandra Kwiatkowska 4.4	Wednesday 9:00	HS11
Udayan Darji 4.8	Monday 10:30	HS16
Hugo Adrian Maldonado Garcia 4.19	Monday 11:00	HS16
Teja Kac 4.14	Monday 11:30	HS16
Paweł Krupski 4.16	Monday 12:00	HS16
Magdalena Nowak 4.20	Tuesday 14:30	HS13
Lucas Henrique Rocha de Souza 4.21	Tuesday 15:00	HS13
Alejandro Illanes 4.13	Tuesday 16:00	HS13
Rodrigo Hernandez-Gutierrez 4.12	Tuesday 16:30	HS13 (online)
Sergio Macias 4.18	Tuesday 17:00	HS13 (online)
Rene Gril Rogina 4.11	Wednesday 10:30	HS11
Goran Erceg 4.9	Wednesday 11:00	HS11
Judy Kennedy 4.15	Wednesday 11:30	HS11
Iztok Banič 4.5	Wednesday 12:00	HS11
Peter Goričan 4.10	Thursday 10:30	HS17
Tina Sovič 4.22	Thursday 11:00	HS17
Boštjan Lemež 4.17	Thursday 11:30	HS17
Matevž Črepnjak 4.7	Thursday 12:00	HS17

2.2 Functional Analysis in Topology (FA)

Organizers: Damian Sobota

Speaker	Time	Place
Grzegorz Plebanek 4.23	Monday 9:00	HS14
Antonio Aviles 4.26	Monday 10:30	HS14
Jerzy Kąkol 4.35	Monday 11:00	HS14
Arkady Leiderman 4.36	Monday 11:30	HS14
Paul Gartside 4.29	Monday 12:00	HS14
Christian Bargetz 4.27	Tuesday 10:30	HS17
Witold Marciszewski 4.37	Tuesday 11:00	HS17
Saak Gabriyelyan 4.28	Tuesday 11:30	HS17
Nayan Adhikary 4.24	Tuesday 12:00	HS17 (online)
Joel Aguilar 4.25	Thursday 14:30	HS13 (online)
Michał Godziszewski 4.31	Thursday 15:00	HS13 (online)
Damian Głodkowski 4.30	Thursday 16:00	HS13
Sebastian Jachimek 4.34	Thursday 16:30	HS13
Tommaso Russo 4.38	Thursday 17:00	HS13
David Schrittesser 4.39	Thursday 17:30	HS13

2.3 Foliation Theory (FT)

Organizers: Olga Lukina, Hiraku Nozawa

Speakers:

Speaker	Time	Place
Sam Nariman 4.40	Thursday 9:00	HS11
Yoshihiko Mitsumatsu 4.53	Monday 10:30	HS17
Masanori Adachi 4.41	Monday 11:00	HS17 (online)
Ramón Barral Lijó 4.44	Monday 11:30	HS17
Davide Ravotti 4.55	Monday 12:00	HS17
Taro Asuke 4.43	Monday 16:00	HS17 (online)
Matilde Martínez 4.48	Monday 16:30	HS17 (online)
Maik Gröger 4.45	Monday 17:00	HS17
Shota Mori 4.54	Thursday 10:30	HS16 (online)
Hirokazu Maruhashi 4.49	Thursday 11:00	HS16 (online)
Sébastian Alvarez 4.42	Thursday 14:30	HS17
Morimichi Kawasaki 4.47	Thursday 15:00	HS17
Carlos Meniño Cotón 4.52	Thursday 16:00	HS17
Marianne Rydzek 4.56	Thursday 16:30	HS17 (online)
Gaël Meigniez4.51	Thursday 17:00	HS17 (online)
Steve Hurder 4.46	Friday 10:30	HS13
Shuhei Maruyama 4.50	Friday 11:00	HS13
Paweł Walczak 4.57	Friday 11:30	HS13

2.4 Geometric Group Theory (GGT)

Organizers: Kasia Jankiewicz, Yash Lodha, Rachel Skipper, Daniel Studenmund

Speaker	Time	Place
Sebastian Hensel 4.58	Monday 9:00	HS13
Benjamin Brück 4.61	Monday 10:30	HS13
Mireille Soergel 4.75	Monday 11:00	HS13
Bakul Sathay 4.74	Monday 11:30	HS13
Annette Karrer 4.66	Monday 12:00	HS13
Oussama Bensaid 4.59	Tuesday 10:30	HS16 (online)
Thomas Ng 4.71	Tuesday 11:00	HS16
Adélie Garin 4.64	Tuesday 11:30	HS16 (online)
Ric Wade 4.77	Tuesday 12:00	HS16
Michael Brandenbursky 4.60	Tuesday 16:00	HS16
Catherine Pfaff 4.72	Tuesday 16:30	HS16
Srivatsav Ellayavalli Kunnawalkam 4.67	Tuesday 17:00	HS16 (online)
Chenxi Wu 4.76	Tuesday 17:30	HS11 (online)
Jone Lopez de Gamiz Zearra 4.69	Tuesday 18:00	HS11 (online)
Waltraud Lederle 4.68	Wednesday 10:30	HS16
Yuri Sanntos Rego 4.73	Wednesday 11:00	HS16
Francesco Fournier-Facio 4.62	Wednesday 11:30	HS16
Justin Moore 4.70	Wednesday 12:00	HS16 (online)
Dominik Francoeur 4.63	Thursday 14:30	HS11
Jonah Gaster 4.65	Thursday 15:00	HS11

2.5 Set-theoretic Topology (ST)

Organizers: Boaz Tsaban, Lyubomyr Zdomsky

Speaker	Time	Place
Leandro Aurichi 4.78	Thursday 9:00	HS13
Andrea Medini 4.90	Monday 16:00	HS14
Justin Moore 4.91	Monday 16:30	HS14 (online)
Collins Amburo Agyingi 4.80	Monday 17:00	HS14
Tom Richmond 4.94	Tuesday 14:30	HS17
Vesko Valov 4.99	Tuesday 15:00	HS17
Franklin Tall 4.98	Tuesday 16:00	HS17
Ivan Gotchev 4.85	Tuesday 16:30	HS17
Aura Lucina Kantún-Montiel 4.88	Tuesday 17:00	HS17
T. M. G. Ahsanullah 4.79	Tuesday 17:30	HS17
Peter Nyikos 4.92	Wednesday 10:30	HS17
Mouadi Hassan 4.87	Wednesday 11:00	HS17
Olga Sipacheva 4.96	Wednesday 11:30	HS17
Pratulananda Das 4.83	Wednesday 12:00	HS17
Salvatore Scamperti 4.95	Thursday 10:30	HS13
Serhii Bardyla 4.82	Thursday 11:00	HS13
Sergey Antonyan 4.81	Thursday 11:30	HS13
Sang-Eon Han 4.86	Thursday 12:00	HS13
Evgenii Reznichenko 4.93	Friday 10:30	HS16 (online)
Fortunato Maesano 4.89	Friday 11:00	HS16 (online)
Davide Giacopello 4.84	Friday 11:30	HS16 (online)
Corey Switzer 4.97	Friday 12:00	HS16

2.6 Topological Dynamics (TD)

Organizers: Lori Alvin, Ľubomír Snoha

Speaker	Time	Place
Xiangdong Ye 4.100	Tuesday 9:00	HS13 (online)
Kristijan Kilassa Kvaternik 4.107	Monday 16:00	HS16
Sonja Štimac 4.115	Monday 16:30	HS16
Dyi-Shing Ou 4.112	Monday 17:00	HS16
Dominik Kwietniak 4.109	Tuesday 10:30	HS13 (online)
Matúš Dirbák 4.104	Tuesday 11:00	HS13
Michael Megrelishvili 4.110	Tuesday 11:30	HS13
Habibeh Pourmand 4.113	Tuesday 12:00	HS13
Andrzej Biś 4.103	Thursday 14:30	HS16
Piotr Bartłomiejczyk 4.102	Thursday 15:00	HS16
Olivier Olela Otafudu 4.111	Thursday 16:00	HS16
Till Hauser 4.105	Thursday 16:30	HS16
Chenxi Wu 4.116	Thursday 17:00	HS16 (online)
Łukasz Cholewa 4.6	Thursday 17:30	HS16
Peter Raith 4.114	Friday 10:30	HS14
Przemysław Kucharski 4.108	Friday 11:00	HS14
Héctor Barge 4.101	Friday 11:30	HS14
Olena Karpel 4.106	Friday 12:00	HS14

2.7 Tiling Spaces (TS)

Organizers: Henna Koivusalo, Jamie Walton

Speaker	Time	Place
Lorenzo Sadun 4.117	Wednesday 9:00	HS13
Johannes Kellendonk 4.129	Tuesday 9:00	HS11
Jianlong Liu 4.131	Tuesday 9:30	HS11
Tobias Hartnick 4.126	Tuesday 10:30	HS11 (cancelled)
Dan Rust 4.132	Tuesday 11:00	HS11
Dirk Frettlöh 4.122	Tuesday 11:30	HS11
Alexey Garber 4.125	Tuesday 12:00	HS11
María Isabel Cortez 4.121	Tuesday 14:30	HS11
Maryam Hosseini 4.127	Tuesday 15:00	HS11
Akshat Das 4.119	Tuesday 16:00	HS11 (online)
Thomas Fernique 4.123	Tuesday 16:30	HS11
Jeong-Yup Lee 4.130	Tuesday 17:00	HS11
Nicolas Bedaride 4.118	Wednesday 10:30	HS13
Franz Gähler 4.124	Wednesday 11:00	HS13
Christopher Cabezas 4.120	Wednesday 11:30	HS13
Shrey Sanadhya 4.134	Wednesday 12:00	HS13
Mike Whittaker 4.136	Thursday 10:30	HS11
Hyeeun Jang 4.128	Thursday 11:00	HS11 (cancelled)
Yaar Solomon 4.135	Thursday 11:30	HS11
Lorenzo Sadun 4.133	Thursday 12:00	HS11

3 Participants List

Name		Affliation	Session 1	Session 2
Masanori	**Adachi**	Shizuoka University	FT4.41	TD
Nayan	**Adhikaryi**	Jadavpur University	FA 4.24	TD
Claudio	**Agostini**	Università degli studi di Torino	ST	TD
Joel	**Aguilar**	Univ. Michoacana de San Nicolás de Hidalgo	FA4.25	
Collins Amburo	**Agyingi**	University of South Africa	ST4.80	FA
T. M. G.	**Ahsanullah**	King Saud University	ST4.79	
Sebastien	**Alvarez**	Univ. de la República, Uruguay	FT4.42	GGT
Lori	**Alvin**	Furman University	TD	CT
Sergey	**Antonyan**	National University of Mexico (UNAM)	ST4.81	FA
Ana	**Anušić**	University of São Paulo	CT	TD
Taro	**Asuke**	University of Tokyo	FT4.43	TD
Leandro	**Aurichi**	University of Sao Paulo	ST4.78	
Antonio	**Aviles**	University of Murcia	FA4.26	ST
Iztok	**Banič**	University of Maribor	CT 4.5	TD
Serhii	**Bardyla**	University of Vienna	ST4.82	
Héctor	**Barge**	Univ. Politécnica de Madrid	TD4.101	
Christian	**Bargetz**	Universität Innsbruck	FA4.27	
Ramon	**Barral Lijo**	Ritsumeikan University	FT4.44	TS
Piotr	**Bartłomiejczyk**	Gdańsk University of Technology	TS4.102	
Nicolas	**Bedaride**	Université Aix Marseille	TS4.118	TD
Joseph	**Bedich**	University of Pittsburgh	ST	CT
Oussama	**Bensaid**	University of Paris	GGT4.59	
Jeffrey	**Bergfalk**	University of Barcelona	ST4.1	FA
Jasmine	**Bhullar**	University of Houston	TD	GGT
Andrzej	**Biś**	University of Łódź, Poland	TD4.103	CT
Jan	**Boroński**	AGH Kraów	CT	TD
Philip	**Boyland**	University of Florida at Gainesville	TD	CT
Michael	**Brandenbursky**	Ben Gurion University	GGT4.60	
Benjamin	**Brück**	ETH Zürich	GGT4.61	
Henk	**Bruin**	University of Vienna	TD	CT
Jorge	**Bruno**	University of Winchester	ST	
Alvaro	**Bustos-Gajardo**	The Open University	TS	TD
Christopher	**Cabezas**	Université de Picardie Jules Verne	TS4.120	TD
Christopher	**Cashen**	University of Vienna	GGT	
Łukasz	**Cholewa**	AGH Kraów	CT4.6	TD
Jernej	**Činč**	AGH Kraów / University of Ostrava	TD	CT
María Isabel	**Cortez**	Pontificia Universidad Católica de Chile	TS4.121	FT

Name		Affliation	Session 1	Session 2
Matevž	**Črepnjak**	University of Maribor	CT4.7	
Udayan	**Darji**	University of Louisville	CT4.8	TD
Akshat	**Das**	University of Houston	TS4.119	TD
Pratulananda	**Das**	Jadavpur University, Kolkata	ST4.83	FA
Matúš	**Dirbák**	Matej Bel University	TD4.104	
Roman	**Dörner**	University of Vienna		
Goran	**Erceg**	University of Split	CT4.9	TD
Thomas	**Fernique**	CNRS Univ. Paris 13	TS4.123	
Vera	**Fischer**	University of Vienna	ST	FA
Francesco	**Fournier-Facio**	ETH Zurich	GGT4.62	TD
Dominik	**Francoeur**	Instituto de Ciencias Matematicas	GGT4.63	
Dirk	**Frettlöh**	Universität Bielefeld	TS4.122	
Gabriel	**Fuhrmann**	Durham University	TD	TS
Saak	**Gabriyelyan**	Ben Gurion University of the Negev	FA4.28	ST
Franz	**Gähler**	Bielefeld University	TS4.124	
Alexey	**Garber**	University of Texas Rio Grande Valley	TS4.125	
Adélie	**Garin**	EPFL Lausanne	GGT4.64	
Paul	**Gartside**	University of Pitsburgh	ST4.29	FA
Jonah	**Gaster**	University of Wisconsin-Milwaukee	GGT4.65	TS
Davide	**Giacopello**	Univ. of Messina	ST4.84	FA
Katrina	**Gibbins**	University of Glasgow	TS	
Damian	**Głodkowski**	University of Warsaw	FA4.30	ST
Michał	**Godziszewski**	University of Warsaw	ST4.31	CT
Peter	**Goričan**	University of Ljubljana	CT4.10	
Ivan	**Gotchev**	Central Connecticut State University	ST4.85	
Rene	**Gril Rogina**	University of Maribor	CT4.11	TD
Maik	**Gröger**	Jagiellonian University	FT4.45	TS
Valentin	**Haberl**	University of Vienna		
Sang-Eon	**Han**	Jeonbuk National University	ST4.86	FA
Tobias	**Hartnick**	Karisruher Institut für Technologie	TS4.126	
Mouadi	**Hassan**	Ibn Zohr University, Morocco	ST4.87	GGT
Lino	**Haupt**	Friedrich-Schiller-Universität Jena	TD	CT
Till	**Hauser**	Max-Planck-Institute for mathematics	CT4.105	TS
Sebastian	**Hensel**	LMU Munich	GGT4.58	FT
Rodrigo	**Hernandez-Gutierrez**	Univ. Auton. Metropol., Iztapalapa	CT4.12	ST
Maryam	**Hosseini**	postdoc	TD	TS4.127
Roman	**Hric**	Matej Bel University	TD	CT
Steven	**Hurder**	University of Illinois at Chicago	FT4.46	TS
Alejandro	**Illanes**	Universidad Nac. Auton. de Mexico	CT4.13	
Kohei	**Iwamoto**	Ritsumeikan University		

Name		Affliation	Session 1	Session 2
Sebastian	**Jachimek**	University of Wrocław	FA4.34	ST
Hyeeun	**Jang**	George Washington University	TS4.128	TD
Kasia	**Jankiewicz**	University of California Santa Cruz	GGT	
Yongsheng	**Jia**	University of Manchester	GGT	FT
Teja	**Kac**	University of Maribor	CT4.14	
Jerzy	**Kąkol**	Mickiewicz University, Poznań	FA4.35	
Aura Lucina	**Kantún-Montiel**	Universidad del Papaloapan	ST 4.88	
Olena	**Karpel**	AGH Kraów	TD4.106	
Annette	**Karrer**	Technion – Institute of Technology	GGT4.66	GGT
Morimichi	**Kawasaki**	Aoyama Gakuin University	FT4.47	GGT
Johannes	**Kellendonk**	Université Lyon 1	TS4.129	TD
Judy	**Kennedy**	Lamar University	CT4.15	TD
Noureen	**Khan**	University of North Texas at Dallas		
Kristijan	**Kilassa Kvaternik**	University of Zagreb	TD4.107	CT
Marlene	**Koelbing**	Universität Wien	ST	
Henna	**Koivusalo**	University of Bristol	TS	
Piotr	**Koszmider**	Polish Academy of Sciences	FA	ST
Paweł	**Krupski**	University of Wrocław	CT4.16	TD
Przemysław	**Kucharski**	AGH Kraów	CT4.108	TD4.108
Srivatsav	**Kunnawalkam Elayavalli**	Vanderbilt University	GGT4.67	
Aleksandra	**Kwiatkowska**	Univ. of Münster/Univ. of Wrocław	CT4.4	TD
Dominik	**Kwietniak**	Jagiellonian University, Kraów	TD4.109	TS
Waltraud	**Lederle**	UC Louvain	GGT4.68	TD
Jeong-Yup	**Lee**	Catholic Kwandong University	TS4.130	TS
Arkady	**Leiderman**	Ben-Gurion University of the Negev	FA4.36	ST
Boštjan	**Lemež**	University of Ljubljana	CT4.17	
Jianlong	**Liu**	University of Maryland College Park	TS4.131	FT
Yash	**Lodha**	University of Vienna	GGT	
Jone	**Lopez de Gamiz Zearra**	University of Warwick	GGT4.69	
Olga	**Lukina**	University of Vienna	FT	TS

Name		Affliation	Session 1	Session 2
Sergio	**Macías**	National University of Mexico	CT 4.18	
Fortunato	**Maesano**	Univ. of Messina	ST4.89	FA
Hugo Adrian	**Maldonado Garcia**	UNAM	CT 4.19	
Witold	**Marciszewski**	University of Warsaw	FA4.37	ST
Matilde	**Martínez**	Universidad de la República	FT4.48	TS
Hirokazu	**Maruhashi**	Chiba University	GGT4.49	TS
Shuhei	**Maruyama**	Nagoya University	FT4.50	GGT
Yoshifumi	**Matsuda**	Aoyama Gakuin University	FT	GGT
Andrea	**Medini**	TU Wien	ST4.90	
Michael	**Megrelishvili**	Bar-Ilan University	TD4.110	
Carlos	**Meniño Cotón**	Universidade de Vigo	FT	TS
Julia	**Millhouse**	University of Vienna	ST	FA
Yoshihiko	**Mitsumatsu**	Chuo University	FT4.53	GGT
Justin	**Moore**	Cornell University	GGT4.70	ST4.91
Shota	**Mori**	Nagoya University, Japan	FT4.54	
Sam	**Nariman**	Purdue University	FT4.40	GGT
Thomas	**Ng**	Technion	GGT4.71	
Magdalena	**Nowak**	Jan Kochanowski University	CT 4.20	FA
Hiraku	**Nozawa**	Ritsumeikan University	FT	TS
Peter	**Nyikos**	Univ. of South Carolina, Columbia	ST4.92	FA
Olivier	**Olela Otafudu**	North-West Univesity, Potchefstroom	ST	TD4.111
Dyi-Shing	**Ou**	AGH Kraów	TD4.112	CT
Catherine	**Pfaff**	Queen's University	GGT4.72	
Grzegorz	**Plebanek**	University of Wrocław	FA4.23	ST
Carole	**Porrier**	Université Sorbonne Paris Nord	TS	GGT
Habibeh	**Pourmand**	Jagiellonian University	TD4.113	CT
Silvia	**Radinger**	University of Vienna	TD	TS
Peter	**Raith**	Universität Wien	TD4.114	CT
Davide	**Ravotti**	University of Vienna	FT4.55	TD
Flavia	**Remo**	Friedrich-Schiller University Jena	TD	TD
Evgenii	**Reznichenko**	Lomonosov Moscow State Univ.	ST4.93	FA
Tom	**Richmond**	Western Kentucky University	ST4.94	
Lucas Henrique	**Rocha de Souza**		CT4.21	GGT
Tommaso	**Russo**	Czech Academy of Sciences	FA4.38	ST
Dan	**Rust**	The Open University	TS4.132	TD
Karol	**Rutkowski**	Jagiellonian University	TS	TD
Marianne	**Rydzek**	University of Strasbourg	FT4.56	TD

Name		Affliation	Session 1	Session 2
Lorenzo	**Sadun**	University of Texas	TS4.117	TS4.133
Shrey	**Sanadhya**	Ben Gurion University of the Negev	TS4.134	TD
Slade	**Sanderson**	Utrecht University	TD	TS
José M.R.	**Sanjurjo**	Universidad Complutense	TS	CT
Yuri	**Santos Rego**	Von Güricke University Magdeburg	GGT4.73	FT
Bakul	**Sathaye**	University of Münster	GGT 4.74	TD
Salvatore	**Scamperti**	University of Turin	ST4.95	TS
Lukas	**Schembecker**	University of Vienna, KGRC		
Claude (Chaim)	**Schochet**	Technion, Haifa		
David	**Schrittesser**	University of Vienna	FA4.39	
Saharon	**Shelah**	Hebrew University of Jerusalem	ST4.3	
Steffania	**Sierra Galvis**	Université de Bordeaux	TS	GGT
Pradeep	**Singh**	IIT Delhi	TS	TD
Olga	**Sipacheva**	Moscow State University	ST4.96	
Rachel	**Skipper**	The Ohio State University	GGT	
Ľubomír	**Snoha**	Matej Bel University, Banská Bystrica	TD	
Damian	**Sobota**	Universität Wien	FA	ST
Mireille	**Soergel**	Université de Bourgogne	GGT4.75	
Yaar	**Solomon**	Ben Gurion University of the Negev	TS4.135	TD
Tina	**Sovič**	University of Maribor	CT4.22	
Sonja	**Štimac**	University of Zagreb	TD4.115	CT
Daniel	**Studenmund**	Binghamton University	GGT	
Corey	**Switzer**	University of Vienna	ST4.97	CT
Franklin	**Tall**	University of Toronto	ST4.98	FA
Juliane	**Trianon-Fraga**	University of São Paulo	ST	
Murat	**Tuncali**	Nipissing University	CT	TD
Hafiz	**Ullah**	Abasyn University Peshawar,	ST	TD
Vesko	**Valov**	Nipissing University	ST4.99	
Jan	**van Mill**	University of Amsterdam	ST	FA
Richard	**Wade**	University of Oxford	GGT4.77	
Paweł	**Walczak**	Uniwersytet Łódzki	FT4.57	TD
James	**Walton**	University of Nottingham	TS	TD
Alexander	**Wendlinger**	University of Vienna/KGRC		
Mike	**Whittaker**	University of Glasgow	TS4.136	TD
Wolfgang	**Wohofsky**	University of Vienna	ST	
Chenxi	**Wu**	UW Madison	GGT4.76	TD4.116
Kaori	**Yamaguchi**	Ritsumeikan University	GGT	TD
Xiangdong	**Ye**	Univ. of Science and Techn. of China	TD4.100	
Lynne	**Yengulalp**	Wake Forest University	ST	
Krzysztof	**Zakrzewski**	University of Warsaw	FA	ST
Nicolò	**Zava**	IST Austria	GGT	ST
Lyubomyr	**Zdomskyy**	University of Vienna	STT	FA

4 Abstracts

4.1 Plenary Speakers

Presentation 4.1. **Time and Place:** Monday 17:30, HS14, see 1.
Plenary Speaker: Jeffrey Bergfalk
Title: Cross-pollinations of descriptive set theory and homological algebra
Abstract: The core of this talk will be a series of works, joint with Martino Lupini and Aristotelis Panagiotopoulos, lying at the interface of descriptive set theory and homological algebra — works taking their place within a broader contemporary impulse to systematically "do algebra with topology". Animating these works is a simple but far-reaching recognition, which is this: many of the classical functors $F : \mathcal{C} \to \mathcal{D}$ of homological algebra and algebraic topology factor through a "definable version" of the category $\mathcal{D}$; examples include Čech cohomology, $\lim^1$, and Ext, each viewed as a functor to the category $\mathtt{Ab}$ of abelian groups. The lifts of these functors to a more rigid, "definable" version of $\mathtt{Ab}$, namely the category $\mathtt{GPC}$ of *groups with a Polish cover*, record significantly more information about their sources than their classical counterparts. Moreover, as Lupini has recently shown, the category $\mathtt{GPC}$ is of some algebraic significance in its own right. We will conclude by reviewing the derived category framework in which this significance manifests, and in which these works connect with the subjects of this author's previous Mary Ellen Rudin lecture, "Cross-pollinations of set theory and algebraic topology".

Presentation 4.2. **Time and Place:** Friday 9:00, HS14, see 1.
Plenary Speaker: Philip Boyland
Title: When Topology forces Dynamics
Abstract: We describe various situations where topological phenomenon like the structure of a base space or the action on π_1 or H_1 force dynamical complexity. These results often take the form of a stability theorem: there is a model system with well-understood, complicated dynamics and one proves that these dynamics persist under large perturbations as long as one stays on the same manifold or in the same homotopy class. We give various dynamical applications of these results such as invariant decompositions and an analog of Sharkovskii's theorem for surface dynamics as well as physical applications to fluid mixing and Hamiltonian dynamics on hyperbolic manifolds.

Presentation 4.3. **Time and Place:** Monday 14:30, HS14, see 1.
Plenary Speaker: Saharon Shelah
Title: Partition theorems for uncountable expanded trees
Abstract: We look for partition theorems for large subtrees for suitable uncountable trees and colourings. We concentrate on subtrees of ${}^{\kappa}\mathfrak{g}2$ expanded by a well ordering of each level. Unlike earlier works, we do not ask the embedding to preserve the height of the tree. We get consistency results without large cardinals. On background see for example Dobrinen-Shelah. The intention is to apply it to model theoretic problems.

4.2 Continuum Theory

Presentation 4.4. **Time and Place:** Wednesday 9:00 HS11, see 1
Semi-Plenary Speaker: Aleksandra Kwiatkowska
Title: Projective Fraisse limit of finite connected graphs with confluent epimorphisms
Abstract: In the talk we discuss properties of the continuum obtained as the topological realisation of the projective Fraisse limit of the family of finite connected graphs with confluent epimorphisms. This continuum turns out to be pointwise self-homeomorphic, each point is the top of the Cantor fan, but it is not homogeneous. Moreover, it is indecomposable, but not hereditarily indecomposable, as arc components are dense. It is one-dimensional, Kelley, hereditarily unicoherent, hence the circle does not embed; nevertheless, solenoids and the pseudo-arc do embed into the continuum. This is joint work with W. Charatonik and R. Roe.

Presentation 4.5. **Time and Place:** Wednesday 12:00 HS11, see 2.1
Speaker: Iztok Banic
Title: Mappings of inverse limits revisited[3]
Abstract: We revisit the results from two papers, Mioduszewski's "Mappings of inverse limits" and Feuerbacher's "Mappings of inverse limits revisited" to obtain new mapping theorems for inverse limits of inverse sequences of compact metric spaces with continuous single-valued bonding functions. Then, we apply the results to the theory of inverse limits of inverse sequences of compact metric spaces with upper semi-continuous set-valued bonding functions to obtain new mapping theorems for such inverse limits. This is joint work with Goran Erceg and Judy Kennedy.

Presentation 4.6. **Time and Place:** Thursday 17:30 HS16, see 2.6
Speaker: Łukasz Cholewa
Title: On dynamics of Lorenz maps - Renormalizations and primary $n(k)$ -cycles
Abstract: Lorenz maps are one-dimensional maps with a single discontinuity, which appear in a natural way as Poincarè maps in geometric models of well-known Lorenz attractor. The main object considered in this talk will be renormalizations of expanding Lorenz maps and their connections with some special periodic orbits (so-called primary $n(k)$-cycles), invariant sets, rotation number and matching property. The talk will be based on a joint work with Piotr Oprocha (AGH University of Science and Technology).

Presentation 4.7. **Time and Place:** Thursday 12:00 HS17, see 2.1
Speaker: Matevž Črepnjak
Title: Set-valued functions with Markov property and generalized inverse limits
Abstract: Recently, various approaches have been introduced to study when two generalized inverse limits are homeomorphic. One of the most common approaches is detecting properties of coordinate spaces and set-valued bonding functions that imply that the corresponding inverse limits are homeomorphic. In the talk, we present such properties of coordinate spaces and set-valued bonding functions. They generalize the properties of well-known Markov functions on intervals. First, we allow the graphs of the bonding functions in the inverse sequence to be 2-dimensional. Then, we allow the coordinate spaces in the inverse sequence to be an arbitrary continuum. In both cases, the results generalize some results of Holte, Banic, Crepnjak, Lunder, Alvin, Kelly, and Imamura.

This is joint work with Iztok Banic and Teja Kac.

Presentation 4.8. **Time and Place:** Monday 10:30 HS16, see 2.1
Speaker: Udayan Darji
Title: Local entropy and Continua
Abstract: We will discuss some results and open questions concerning the relationship between local entropy and complexity among continua.

Presentation 4.9. **Time and Place:** Wednesday 11:00 HS11, see 2.1
Speaker: Goran Erceg
Title: Minimal Dynamical systems with closed relations II
Abstract: We introduce a new notion of the omega limit set for dynamical systems with closed relations on compact metric spaces. We define several types of minimality and investigate their connections with types previously defined by the authors. Further, we show that topological conjugation preserves all types of minimalities. This is joint work with Iztok Banič, Rene Gril Rogina and Judy Kennedy.

Presentation 4.10. **Time and Place:** Thursday 10:30 HS17, see 2.1
Speaker: Peter Goričan
Title: Big and large continua in inverse limits of inverse systems over directed graphs
Abstract: In the theory of generalized inverse limits it is a well-known fact that the generalized inverse limits may not be connected even if all the factor spaces are closed intervals. However, it has been shown recently by Banic and Kennedy that such generalized inverse limits always contain large continua, if the bonding functions have connected and surjective graphs. We generalize the notion of generalized inverse limits of inverse sequences of closed intervals with upper semicontinuous bonding functions to inverse limits of inverse systems over directed graphs and show that under certain conditions, such inverse limits also contain large continua.

Presentation 4.11. **Time and Place:** Wednesday 10:30 HS11, see 2.1
Speaker: Rene Gril Rogina
Title: Minimal dynamical systems with closed relations I
Abstract: We introduce dynamical systems with closed relations on compact metric spaces and discuss different types of minimality of such dynamical systems, all of them generalizing minimal dynamical systems with a continuous function on a compact metric space. In particular, we define 1-minimal, ∞-minimal, $1^{\oplus}$-minimal, $2^{\oplus}$-minimal and $3^{\oplus}$-minimal dynamical systems with closed relations and discuss relations among them. This is joint work with Iztok Banic, Goran Erceg and Judy Kennedy.

Presentation 4.12. **Time and Place:** Tuesday 16:30 HS13, see 2.1
Speaker: Rodrigo Hernandez-Gutierrez
Title: The hyperspace of noncut subcontinua of a hairy dendrite
Abstract: For a metric continuum X let $NC^*(X)$ be the set of all subcontinua Y of X such that $X \setminus Y$ is connected, metrized by the Hausdorff metric. I will present the following result obtained jointly with Jorge E. Vega: if X is a dendrite whose set of ramification points is dense, then $NC^*(X)$ is homeomorphic to the Baire space of irrational numbers.

Presentation 4.13. **Time and Place:** Tuesday 16:00 HS13, see 2.1
Speaker: Alejandro Illanes
Title: Problems and solutions on Continuum Theory and its Hyperspaces
Abstract: In this talk we will present some solutions to open problems on continua and hyperspaces, we include problems related to the Jones's function T and on induced mappings on hyperspaces.

Presentation 4.14. **Time and Place:** Monday 11:30 HS16, see 2.1
Speaker: Teja Kac
Title: Rigid continua and their inverse limits
Abstract: We give mapping theorems for certain families of rigid continua; i.e., we give a mapping theorem for stars, paths and cycles of Cook continua. We also introduce the degree of rigidity of a continuum, the notion of 1n-rigid continua and provide some existence theorems for $\frac{1}{n}$-rigid continua. We also construct a non-trivial infinite family of pairwise non-homeomorphic continua X with the property that for any sequence (fn) of continuous surjections $f_n : X \to X$, the inverse limit $\varprojlim\{X, f_n\}_{n=1}^{\infty}$ is homeomorphic to X. Explicitly, we show that for each positive integer n, every $\frac{1}{n}$-rigid continuum has this property.

Presentation 4.15. **Time and Place:** Wednesday 11:30 HS11, see 2.1
Speaker: Judy Kennedy
Title: Two lines and a Lelek fan
Abstract: This is joint work with Iztok Banič and Goran Erceg. We give an example of an inverse limit with with bonding map one set-valued function such that the resulting space is a Lelek fan. Also, the induced shift map on the inverse limit has one fixed point, no other periodic points, and has positive topological entropy.

Presentation 4.16. **Time and Place:** Monday 12:00 HS16, see 2.1
Speaker: Paweł Krupski
Title: On the hyperspace of simple closed curves in the plane
Abstract: This is a joint work with Krzysztof Omiljanowski (University of Wrocław).

We show that the collection of all simple closed curves in the plane, equipped with Vietoris topology, has an open basis of contractible sets.

Presentation 4.17. **Time and Place:** Thursday 11:30 HS17, see 2.1
Speaker: Boštjan Lemež
Title: An n-Cell as a Generalize Inverse Limit Indexed by the Integers
Abstract: We construct an upper semicontinuous function $f : [0, 1] \to 2^{[0,1]}$ such that the inverse limit of an inverse sequence of closed unit intervals with f as the bonding function indexed by the integers is a 3-cell. R. P. Vernon presented an example of a function such that a 2-cell is obtained as inverse limit and stated a question whether exist a function such that the inverse limit indexed by the integers is an n-cell for $n > 2$. We will also generalize the function f and obtain an n-cell for any positive integer n.

Presentation 4.18. **Time and Place:** Tuesday 17:00 HS13 (online), see 2.1
Speaker: Sergio Macias
Title: On strictly point T-asymmetric continua

Abstract: A *continuum* is a compact, connected, metric space. Given a continuum X, we define Professor Jones' set function $\mathcal{T}$ as follows

$$\mathcal{T}(A) = X \setminus \{x \in X \mid \text{there exists a subcontinuum } W \text{ of } X \text{ such that } x \in Int(W) \subset W \subset X \setminus A\}.$$

A continuum X is *strictly point $\mathcal{T}$-asymmetric* provided that for each pair of distinct points p and q of X with $p \in \mathcal{T}(\{q\})$, we have that $q \in X \setminus \mathcal{T}(\{p\})$. We characterize the class of continua which are strictly point $\mathcal{T}$-asymmetric and consider, the particular case, of the class of dendroids (A *dendroid* is an arcwise connected continuum for which the intersection of two of its subcontinua is connected).

Presentation 4.19. **Time and Place:** Monday 11:00 HS16, see 2.1
Speaker: Hugo Adrian Maldonado Garcia
Title: Complexity of η-od-like continua
Abstract: W. Lewis asked in Indecomposable Continua. Open problems in topology II, whether there exists, for every $\eta \geq 2$, an atriodic simple $(\eta + 1)$-od-like continuum which is not simple η-od-like and, if such continuum exists, whether it has a variety of properties such as being planar or being an arc-continuum, among others. Some partial results have been obtained by W.T. Ingram, P. Minc, C.T. Kennaugh and L. Hoehn. In each case, the most substantial challenge is in proving that a continuum is not T-like, for a given tree T. We present the notion of a combinatorial η-od cover of a graph, a tool which may enable one to prove that certain examples of continua are not η-od-like. Also, we suggest the construction of an atriodic simple $(\eta + 1)$-od-like continuum which is not simple η-od-like and has properties such as being planar, being an arc-continuum and span zero (This is a work in progress).

Presentation 4.20. **Time and Place:** Tuesday 14:30 HS13, see 2.1
Speaker: Magdalena Nowak
Title: Pointwise attractors which are not strict
Abstract: We deal with the Barnsley-Huthinson operator $\mathcal{F}$ associated with the finite family of continuous maps on the normal Hausdorff space. Each nonempty compact subset A of such space is called a strict attractor if it has an open neighborhood U such that $A = \lim_{n\to\infty} \mathcal{F}^n(S)$ for every nonempty compact $S \subset U$. Every strict attractor is a pointwise attractor, which means that the set $\{x \in X; \lim_{n\to\infty} \mathcal{F}^n(x) = A\}$ contains A in its interior.

We present a class of examples of pointwise attractors which are not strict - from the finite set to the Sierpinski carpet.

Presentation 4.21. **Time and Place:** Tuesday 15:00 HS13 (online), see 2.1
Speaker: Lucas Henrique Rocha de Souza
Title: Topological characterizations of the n-dimensional Sierpinski Carpet
Abstract: Whyburn showed that if we take a 2-sphere and remove an infinite collection of open disks satisfying some properties, then we get the 1-dimensional Sierpiński carpet. After that, Cannon generalized it for n-dimensional Sierpiński Carpets, with n different from 3.

Recently, Tshishiku and Walsh gave another characterization of the Sierpiński Carpet: if we take a 2-sphere, remove a countable dense set and replace each point by a circle, then we get a

1-dimensional Sierpiński Carpet. We generalized their result for a n-dimensional Sierpiński Carpet, with n different from 3.

Presentation 4.22. **Time and Place:** Thursday 11:00 HS17, see 2.1
Speaker: Tina Sovič
Title: Δ-related functions and generalized inverse limits
Abstract: For any continuous single-valued functions $f, g : [0,1] \to [0,1]$ we define upper semi-continuous set-valued functions $F, G : [0,1] \multimap [0,1]$ by their graphs as the unions of the diagonal Δ and the graphs of set-valued inverses of f and g respectively. We introduce when two functions are Δ-related and show that if f and g are Δ-related, then the generalized inverse limits $\varprojlim F$ and $\varprojlim G$ are homeomorphic.

4.3 Functional Analysis in Topology

Presentation 4.23. **Time and Place:** Monday 9:00, HS14, see 1.
Speaker: Grzegorz Plebanek
Title: Almost disjoint families and Banach spaces
Abstract: To every almost disjoint family $\mathcal{A}$ of subsets of the set of natural numbers one can associate a compact space $K_{\mathcal{A}}$ which is a scattered space with the third derivative empty. The plan is to discuss some properties of Banach spaces of the form $C(K_{\mathcal{A}})$.

In particular, we will discuss the role of $C(K_{\mathcal{A}})$ spaces in our solution to a problem on twisted sums of c_0 and $C(K)$ spaces, obtained in collaboration with Antonio Aviles and Witold Marciszewski.

We also present the following recent result of Alberto Salguero Alarcon and the speaker: There is a Banach space $C(K)$ and a complemented subspace X of $C(K)$ such that X is not isomorphic to a space of continuous functions.

Presentation 4.24. **Time and Place:** Tuesday 12:00, HS17 (online), see 2.2.
Speaker: Nayan Adhikary
Title: On notions of precompactness, continuity and Lipschitz functions associated with quasi-Cauchy sequences
Abstract: The underlying theme of this article is a class of sequences in metric structures satisfying a much weaker kind of Cauchy condition, namely quasi-Cauchy sequences. We first consider a weaker notion of precompactness based on the idea of quasi-Cauchy sequences and establish several results including a new characterization of compactness in metric spaces. Next we consider the associated idea of continuity, namely, ward continuous functions, as this class of functions strictly lies between the classes of continuous and uniformly continuous functions and mainly establish certain coincidence results. Finally, a new class of Lipschitz functions called "quasi-Cauchy Lipschitz functions" is introduced and again several coincidence results are proved. The motivation behind such kind of Lipschitz functions is ascertained by the observation that every real-valued ward continuous function defined on a metric space can be uniformly approximated by real-valued quasi-Cauchy Lipschitz functions.
This is a joint work with Dr. Sudip Kumar Pal (Diamond Harbour Women's University, India).

Presentation 4.25. **Time and Place:** Tuesday 10:30, HS17, see 2.2.
Speaker: Joel Aguilar
Title: Uniformly dense subspaces in function spaces
Abstract: A set $A \subset C_p(X)$ is said to be uniformly dense if it is dense in the uniform topology. Since the uniform topology is finer than the topology of point-wise convergence, is expected that uniformly dense subspaces behave more nicely than arbitrary dense subspaces of $C_p(X)$. Indeed, there is a collection of properties $\mathcal{P}$ for which having a uniformly dense subspace with $\mathcal{P}$ also implies that $C_p(X)$ has $\mathcal{P}$; it turns out that the Lindelöf property is not one of this. In this talk I will present an example, obtained jointly with R. Rojas-Hernández, of a σ-compact space X such that $C_p(X)$ has a uniformly dense Lindelöf subspace but $C_p(X)$ is not even normal.

Presentation 4.26. **Time and Place:** Monday 10:30, HS14, see 2.2.
Speaker: Antonio Aviles
Title: Compact spaces associated to Banach lattices
Abstract: Given a vector x of a Banach lattice X, the ideal generated by x is canonically identified with a $C(K)$ space. In this way, we associate compact spaces to Banach lattices, and new interesting classes of compact spaces arise.

Presentation 4.27. **Time and Place:** Tuesday 10:30, HS17, see 2.2.
Speaker: Christian Bargetz
Title: On complemented copies of c_0 in spaces of vector-valued continuous functions with the pointwise topology
Abstract: Let X be a Tychonoff space and E be a locally convex space. We denote by $C_p(X, E)$ the space of all continuous functions $X \to E$ equipped with the topology of pointwise convergence. In this talk, we discuss the question of when the space $C_p(X, E)$ contains a complemented copy of the space c_0 equipped with the pointwise topology, i.e. the topology induced by the countable product $\mathbb{R}^\omega$. Moreover we discuss the Josefson-Nissenzweig property of these spaces.

This is joint work with Damian Sobota and Jerzy Kąkol.

Presentation 4.28. **Time and Place:** Tuesday 10:30, HS17, see 2.2.
Speaker: Saak Gabriyelyan
Title: The strong Gelfand–Phillips property for locally convex spaces
Abstract: In my talk I will define and discuss the strong Gelfand–Phillips property for Banach spaces and more generally for locally convex spaces. The talk is based on two joint works [1, 2] with Taras Banakh (Ivan Franko National University of Lviv, Ukraine, and Jan Kochanowski University in Kielce, Poland)

References

[1] T. Banakh, S. Gabriyelyan, *Banach spaces with the (strong) Gelfand–Phillips property*, Banach J. Math. Anal. **45** (2022), art. 24.

[2] T. Banakh, S. Gabriyelyan, *Locally convex spaces with the strong Gelfand–Phillips property*, submitted.

Presentation 4.29. **Time and Place:** Monday 12:00, HS14, see 2.2.
Speaker: Paul Gartside
Title: Compact generators
Abstract: A subset G of the set $C(X)$ of all continuous, real-valued functions on a Tychonoff space X is a *generator* if, whenever x is a point of X not in a closed set C, there is a g in G such that $g(x) \notin \overline{g(C)}$. Considering $C(X)$ with the compact-open topology, and every generator as a subspace: X is metrizable if and only if it is a k-space and has a compact generator. Considering $C(X)$ with the topology of pointwise convergence: X has a compact generator if and only if X is Eberlein-Grothendieck. Joint work with Jeremiah Morgan and Alex Yuschik.

Presentation 4.30. **Time and Place:** Thursday 16:00, HS13, see 2.2.
Speaker: Damian Głodkowski
Title: Coverings of Banach spaces and their subsets by hyperplanes
Abstract: A hyperplane of a Banach space is a closed one-codimensional subspace. For a Banach space X we consider the σ-ideal of all subsets of X that can be covered by countably many hyperplanes and investigate its standard cardinal characteristics i.e. the additivity, the covering number, the uniformity, the cofinality. We completely determine their values for separable Banach spaces in ZFC, and for all nonseparable Banach spaces under additional assumptions such as GCH or MM. We also find an application of our results to the topic of overcomplete sets in Banach spaces. This is joint work with Piotr Koszmider.

Presentation 4.31. **Time and Place:** Thursday 15:00, HS13 (online), see 2.2.
Speaker: Michał Godziszewski
Title: Spectra of maximal almost orthogonal families of projections in the Calkin algebra
Abstract: Let H be an infinite dimensional separable complex Hilbert space with inner product $\langle\cdot|\cdot\rangle$. Let $\mathcal{B}(H)$ be a Banach space of bounded linear operators on H with the operator norm. In case when $H = \ell^2(\omega)$, we can distinguish a particular subalgebra of the Banach space $\mathcal{B}(H)$: we define $\mathcal{K}(H)$ as the smallest Banach subalgebra of $\mathcal{B}(H)$ containing all finite-dimensional operators, and we call its elements compact operators. So, $T \in \mathcal{B}(H)$ is compact if it is a limit of finite-rank operators.[1] The collection $\mathcal{K}(H)$ has the structure of a C*-algebra and is a ring-theoretical ideal in $\mathcal{B}(H)$.

The Calkin algebra is the quotient C*-algebra

$$\mathcal{C}(H) = \mathcal{B}(H)/\mathcal{K}(H),$$

where the quotient mapping is denoted by $\pi : \mathcal{B}(H) \to \mathcal{C}(H)$. Every separable C*-algebra is isomorphic to a C*-subalgebra of the Calkin algebra. We are interested in the set of projections in the Calkin algebra, i.e., in the set:

$$P(\mathcal{C}(H)) = \{p \in \mathcal{C}(H) : p = p^* = p^2\}.$$

For a set $A \subseteq \omega$, let P_A be the projection onto $\ell^2(A) \subseteq \ell^2(\omega)$. The map $A \mapsto P_A$ embeds the Boolean algebra $\mathcal{P}(\omega)$ into the space of projections $P(H)$. The map $A \mapsto \pi(P_A)$ defines an embedding of $\mathcal{P}(\omega)/\{fin\}$ into $P(\mathcal{C}(H))$. This map is called the diagonal embedding.

[1] Equivalently, an operator $T \in \mathcal{B}(H)$ is compact if the image of the closed unit ball $B \subset H$ under T is precompact, which in turn is equivalent to T being weak-norm continuous when restricted to B.

A family of projections $A \subseteq P(\mathcal{C}(H))$ is almost orthogonal if the product of any two elements $p, q \in A$ is the zero of the algebra $\mathcal{C}(H)$. In this paper we investigate the possible spectra of maximal almost orthogonal families of projections in the Calkin algebra.

The collection of projections $P(\mathcal{C}(H))$ is a natural object to study, as it can be identified with the lattice of projections on $\mathcal{B}(H)$ modulo a natural equivalence relation, so we can identify elements of $P(\mathcal{C}(H))$ with closed subspaces of $\mathcal{B}(H)$.

An important result by Wofsey is:

Theorem 4.32 (Wofsey, 2007). Let A be a family of disjoint uncountable sets. Then

$$\mathbb{P}_A \text{ ' } \forall X \in A\, \exists Y(|Y| = |X| \,\&\, Y \text{ is a m.a.o.f. }).$$

In other words, for any family of cardinals C there is a forcing notion such that C is included in the spectrum of m.a.o.f.'s. Wofsey's result is an operator-theoretic counterpart of the (positive) result of Hechler concerning spectra of maximal almosts disjoint families of sets. We have been searching for an operator-theoretic counterpart of the (negative) strengthening of Hechler's result on spectra of mad families given by Blass.

Thus, our main question in this paper is: can we isolate conditions, under which a specific set of cardinals C can be not only included, but actually equal to the spectrum of maximal almost orthogonal family of projections in a given model of set theory?

Theorem 4.33. Assume GCH. Let C be a set of cardinals satisfying the following conditions:

- $\forall \kappa \in C\ \ \kappa$ is uncountable,
- C is closed,
- $\forall \kappa \in [\aleph_1, |C|]\ \ \kappa \in C$,
- $\forall \kappa \in C\, cf(\kappa) = \omega \Rightarrow \kappa^+ \in C$.

Then there exists a forcing notion $\mathbb{P}$ such that it satisfies the countable chain condition and forces the spectrum of maximal almost orthogonal families to be exactly C.

This is joint work with Vera Fischer.

Presentation 4.34. **Time and Place:** Thursday 16:30, HS13, see 2.2.
Speaker: Sebastian Jachimek
Title: Combinatorially dual spaces
Abstract: Let $\mathcal{F}$ be a family of finite subsets of ω satysfing some good properties. A combinatorial space, denoted by $X_{\mathcal{F}}$, is a sequential Banach space being a completion of c_00 with respect to the norm

$$\|x\|_{\mathcal{F}} = \sup_{F \in \mathcal{F}} \sum_{k \in F} |x(k)|.$$

During the talk we will present an example of a Banach space induced by $\mathcal{F}$ in a similar way and we give some of its properties. In particular we will see that it is *close* to be a dual space to $X_{\mathcal{F}}$, in some sense.

Presentation 4.35. **Time and Place:** Monday 11:00, HS14, see 2.2.
Speaker: Jerzy Kąkol
Title: On Δ-spaces and spaces $C_p(X)$
Abstract: A topological space X is called a Δ-*space* (weakly Δ-space) if for every decreasing sequence $(D_n)_n$ of (countable) subsets of X with $\bigcap_n D_n = \emptyset$, there is a decreasing sequence $(V_n)_n$ of open subsets of X, $D_n \subset V_n$ for every $n \in N$ and $\bigcap_n V_n = \emptyset$. Research about Δ-spaces is strictly connected with a study of $\mathbb{Q}$-sets, one of the most mysterious objects in $\mathbb{R}$. We proved that X is a Δ-space if and only the dual of $C_p(X)$ endowed with the topology of the uniform convergence on $C_p(X)$-bounded sets carries the finest locally convex topology. This analytic approach provided several new results about Δ-sets and Δ-spaces. Every $\check{C}$ech-complete Δ-space is scattered and every scattered Eberlein compact space is a Δ-space. Nevertheless, compact scattered spaces X not being a Δ-space do exist, for example $X = [0, \omega_1]$. Every metrizable scattered space is a Δ-space. A compact space X is a weakly Δ-space if and only if X is scattered (Kurka).

Presentation 4.36. **Time and Place:** Monday 11:30, HS14, see 2.2.
Speaker: Arkady Leiderman
Title: When is a locally convex space Eberlein-Grothendieck?
Abstract: We undertake a systematic study of those locally convex spaces E such that (E, w) is (linearly) Eberlein-Grothendieck, where w is the weak topology of E.

Let $C_k(X)$ be the space of continuous real-valued functions on a Tychonoff space X endowed with the compact-open topology. The main results to be presented are: (1) For a first-countable space X (in particular, for metrizable X) the space $(C_k(X), w)$ is Eberlein-Grothendieck if and only if X is both σ-compact and locally compact; (2) $(C_k(X), w)$ is linearly Eberlein-Grothendieck if and only if X is compact.

We characterize E such that (E, w) is linearly Eberlein-Grothendieck for several other important classes of locally convex spaces E. Also, we show that the class of E for which (E, w) is linearly Eberlein-Grothendieck preserves linear continuous quotients. This is joint work with Jerzy Kąkol.

Presentation 4.37. **Time and Place:** Tuesday 10:30, HS17, see 2.2.
Speaker: Witold Marciszewski
Title: Complemented subspaces of function spaces $C_p(X \times Y)$, sequences of measures, and ultrafilters
Abstract: The result of Schachermayer and Cembranos asserts that, for a compact space K, the Banach space $C(K)$ of continuous real valued maps on K, contains a complemented copy of the Banach space c_0 if and only if K admits a sequence of regular Borel measures which is weak* convergent, but not weakly convergent. Cembranos and Freniche proved that, for infinite compact spaces K and L, $C(K \times L)$ always contains a complemented copy of c_0. We extend this theorem by exploring spaces $C_p(X)$ with the pointwise topology. We prove that, for all infinite Tikhonov spaces X and Y, the space $C_p(X \times Y)$ either contains a complemented copy of the countable product of real lines R^ω, or contains a complemented copy of c_0 endowed with the pointwise topology. Assuming the continuum hypothesis, we construct a pseudocompact space X such that $C_p(X \times X)$ does not contain a complemented copy of c_0. Our techniques use sequences of finitely supported measures and some special ultrafilters on ω. This is a joint research with Jerzy Kakol, Damian Sobota, and Lyubomyr Zdomskyy.

Presentation 4.38. **Time and Place:** Thursday 17:00, HS13, see 2.2.
Speaker: Tommaso Russo
Title: Weakly Corson compact trees
Abstract: We introduce and study a new topology on trees, that we call the countably coarse wedge topology. Such a topology is strictly finer than the coarse wedge topology and it turns every chain complete, rooted tree into a countably compact topological space. We show the role of such topology in the theory of weakly Corson and weakly Valdivia compacta. In particular, we give the first example of a compact space T whose every closed subspace is weakly Valdivia, yet T is not weakly Corson. This answers a question due to Ondřej Kalenda. Joint work with Jacopo Somaglia.

References

[1] T. Russo and J. Somaglia, *Weakly Corson compact trees*, Positivity **26** (2022), 33.

Presentation 4.39. **Time and Place:** Thursday 17:30, HS13, see 2.2.
Speaker: David Schrittesser
Title: The internal probability measures giving rise to a fixed Loeb measure
Abstract: Nonstandard analysis (invented by Abraham Robinson) makes the idea of infinitesimal and infinite real numbers precise using the ultrapower construction from model theory. A similar viewpoint can be taken in the construction of measure spaces: An "internal" measure (i.e., an ultrapower of measure spaces) gives rise to an "ordinary" measure, called its Loeb measure (as the construction is due to Peter Loeb). In fact, Lebesgue measure, or more generally, any Radon measure can be constructed in this manner from a hyperfinite internal measure (i.e., an ultraproduct of finite measure spaces).

Although the Loeb construction has been a tool for many decades, even in its basic theory one quickly encounters hard and open questions (as is the case in the theory of "ordinary" measures, of course). Keisler and Sun (2004) asked several such questions, motivated by clarifying the interaction of the Loeb measure construction with the "ordinary" product measure construction. In recent joint work with William Weiss and Haosui Duanmu, all but one rather exotic case of these questions have been answered. In this talk, I will explain the Loeb construction, one of Keisler and Sun's questions, our solution, and the remaining open question.

4.4 Foliation Theory

Presentation 4.40. **Time and Place:** Thursday 9:00, HS11, see 1.
Speaker: Sam Nariman
Title: PL homeomorphisms of surfaces and codimension 2 PL foliations
Abstract: Haefliger-Thurston's conjecture predicts that Haefliger's classifying space for codimension n smooth foliations whose normal bundles are trivial is 2n-connected. In this talk, we discuss how one can use Greenberg's model to confirm this conjecture for codimension $2PL$ foliations. As a consequence, we use our version of Mather-Thurston's theorem for PL homeomorphisms to derive

new homological properties for PL surface homeomorphisms. In particular, we answer a question of Epstein regarding the simplicity of the identity component of PL surface homeomorphisms.

Presentation 4.41. **Time and Place:** Monday 11:00, HS17 (online), see 2.3.
Speaker: Masanori Adachi
Title: Harmonic measure and rigidity for actions of lattices in $PSL(2;\mathbb{R})$ on the circle
Abstract: In the 1990s, Frankel and Thurston independently proposed alternative proofs for the Milnor-Wood inequality based on foliated harmonic measures. In particular, Frankel pointed out that Matsumoto's rigidity theorem directly follows from his argument. Revisiting their approach, we shall give a harmonic measure proof for a theorem of Burger, Iozzi and Weinhard: a Milnor-Wood type inequality and a Matsumoto type rigidity theorem for actions of torsion-free, but not necessarily cocompact, lattices of $PSL(2;\mathbb{R})$ on the circle. This is joint work with Yoshifumi Matsuda (Aoyama Gakuin University) and Hiraku Nozawa (Ritsumeikan University).

Presentation 4.42. **Time and Place:** Thursday 14:30, HS17, see 2.3.
Speaker: Sebastien Alvarez
Title: Exceptional minimal sets and regularity
Abstract: I will discuss some geometric and algebraic aspects of groups and pseudogroups acting on 1-dimensional manifolds with exceptional minimal sets, with a special interest in the interaction with the regularity of the action. I will state some results and many questions.

Presentation 4.43. **Time and Place:** Monday 16:00, HS17 (online), see 2.3.
Speaker: Taro Asuke
Title: On the structure of characteristic classes of codimension-one foliations
Abstract: We will introduce some recent results on characteristic classes for foliations and their infinitesimal deformations, especially in the case where the codimension is equal to one. Then, we will pose some questions and conjectures on the structure of the space of such classes.

Presentation 4.44. **Time and Place:** Monday 11:30, HS17, see 2.3.
Speaker: Ramón Barral Lijó
Title: Chaotic dynamics in foliated spaces
Abstract: Devaney characterized chaos for a continuous map using three conditions: existence of a dense orbit, density of periodic orbits, and sensitivity to initial conditions. For group and semigroup actions on Polish spaces, the first two conditions imply the third. Motivated by this result, previous definitions of chaos for foliated spaces have only consider generalizations of the first two conditions, with no mention of sensitivity. In this talk, we will study whether and when this omission is warranted. We present a definition of sensitivity for foliated spaces using the holonomy pseudogroup, showing that most results for groups and semigroups generalize to compact foliated spaces; in particular, existence of a dense leaf and density of compact leaves imply sensitivity. On the other hand, we exhibit a counterexample in the non-compact setting: a smooth and transversely affine foliation by surfaces of an open 4-manifold such that there is a dense leaf and the set of compact leaves is dense, but the holonomy pseudogroup is not sensitive to initial conditions.

Presentation 4.45. **Time and Place:** Monday 17:00, HS17, see 2.3.
Speaker: Maik Gröger
Title: Cantor actions with discrete spectrum and their amorphic complexity

Abstract: Amorphic complexity, originally introduced for integer actions, is a topological invariant which measures the complexity of dynamical systems in the regime of zero entropy. We will introduce its definition for actions by locally compact σ-compact amenable groups on compact metric spaces. Further, we will illustrate some of its basic properties and show why it is tailor-made to study strictly ergodic group actions with discrete spectrum and continuous eigenfunctions. This class of actions includes, in particular, Delone dynamical systems related to regular model sets obtained via cut and project schemes (CPS). Moreover, there is a canonical way to associate such an action to *locally non-degenerate* (a notion recently introduced together with O. Lukina) equicontinuous Cantor actions via their holonomy. Finally, if time permits, we present some explicit bounds for amorphic complexity for actions related to CPS and inflation tilings.

This is joint work with G. Fuhrmann, T. Jäger & D. Kwietniak and O. Lukina.

Presentation 4.46. **Time and Place:** Friday 10:30, HS13, see 2.3.
Speaker: Steven Hurder
Title: Type invariants for solenoidal manifolds
Abstract: A type is an isomorphism class of subgroups of $\mathbb{Q}$. For example, the Vietoris solenoid is classified up to homeomorphism by its type invariant. In this talk we discuss the type invariants associated to a general solenoidal manifold, defined as the inverse limit space of a tower of proper coverings of a compact manifold. Its collection of types give a homeomorphism invariant for the foliated space defined by the solenoid.

Presentation 4.47. **Time and Place:** Thursday 15:00, HS17, see 2.3.
Speaker: Morimichi Kawasaki
Title: Comuting symplectomorphisms and flux homomorphism
Abstract: Let (S, ω) be a closed connected oriented surface whose genus at least two equipped with a symplectic form. Then we show the "non-extendability" of Py's Calabi quasi-morphism, which is defined on the group of Hamiltonian diffeomorphisms. As its application, we obtain the vanishing of the cup product of the fluxes of commuting symplectomorphisms. This result may be regarded as an obstruction for commuting symplectomorphisms.

Presentation 4.48. **Time and Place:** Monday 16:30, HS17 (online), see 2.3.
Speaker: Matilde Martínez
Title: On tilings, amenable equivalence relations and foliated spaces
Abstract: I will describe a family of foliated spaces constructed from tilings on Lie groups. They provide a negative answer to the following question by G.Hector: are leaves of a compact foliated space always quasi-isometric to Cayley graphs? Their construction was motivated by a profound conjecture of Giordano, Putnam and Skau on the classification, up to orbit equivalence, of actions of countable amenable groups on the Cantor set. I will briefly explain how these examples relate to the GPS conjecture. This is joint work with Fernando Alcalde Cuesta and Álvaro Lozano Rojo.

Presentation 4.49. **Time and Place:** Thursday 11:00, HS16 (online), see 2.3.
Speaker: Hirokazu Maruhashi
Title: De Rham cohomology of the weak stable foliation of the geodesic flow of a hyperbolic surface
Abstract: The de Rham cohomology of a foliation is defined in the same way as the de Rham

cohomology of a manifold, except that the tangent bundle of a manifold is replaced with the tangent bundle of a foliation. In this talk we explain the computation of the de Rham cohomology of the weak stable foliation of the geodesic flow of a hyperbolic surface by giving certain 2-step Hodge decomposition. This talk is based on a joint work with Mitsunobu Tsutaya.

Presentation 4.50. **Time and Place:** Friday 11:00, HS13, see 2.3.
Speaker: Shuhei Maruyama
Title: The spaces of non-descendible quasimorphisms and bounded characteristic classes
Abstract: A quasimorphism on a group G is a real-valued function $\mu : G \to \mathbb{R}$ with uniformly bounded $|\mu(gh) - \mu(g) - \mu(h)|$. In this talk, we provide an isomorphism between two vector spaces; the space of homogeneous quasimorphisms on a universal covering group $\widetilde{G}$ that do not descend to G and the space of second bounded characteristic classes of foliated G-bundles. This is joint work with Morimichi Kawasaki (Aoyama Gakuin University).

Presentation 4.51. **Time and Place:** Thursday 17:00, HS17 (online), see 2.3.
Speaker: Gaël Meigniez
Title: TBA
Abstract: TBA.

Presentation 4.52. **Time and Place:** Thursday 16:00, HS17, see 2.3.
Speaker: Carlos Meniño Cotón
Title: Nonperiodic leaves of codimension one foliation
Abstract: It is known that a proper leaf of a C^2 codimension one foliation on a compact manifold belongs to one of the following two classes: leaves with periodic ends or leaves with infinitely many ends. It will be shown an example of a codimension one foliation of class C^1 that admits a proper, nonperiodic leaf with just two ends. This example can be improved in order to get a 5-dimensional manifold that is not homeomorphic to any leaf of any C^2 codimension one foliation on any compact manifold but it can be realized as a leaf in a C^1 codimension one foliation. We remark that our method of construction only allows to produce nonperiodic leaves whose ends are almost periodic leaving open the non almost periodic case.

Presentation 4.53. **Time and Place:** Monday 10:30, HS17, see 2.3.
Speaker: Yoshihiko Mitsumatsu
Title: Flat real analytic circle bundles and the Mather-Thurston map
Abstract: It might be hard to imagine that the Mather-Thurston theory could hold for real analytic folat bundles. We will discuss the case of real analytic flat circle bundles. The Mather-Thurston map in this case does not induces an isomorphisms on homology groups but we show that it is still not very far from that.

Presentation 4.54. **Time and Place:** Thursday 10:30, HS16 (online), see 2.3.
Speaker: Shota Mori
Title: Computation of some leafwise cohomology ring
Abstract: Let G be the group $SL(2, \mathbb{R})$, $P \subset G$ be the parabolic subgroup of upper triangular matrices and $\Gamma \subset G$ be a cocompact lattice. A right action of P on $\Gamma \setminus G$ defines an orbit foliation FP. We compute the leafwise cohomology ring $H*(FP)$ by using a non-abelian harmonic analysis on G.

Presentation 4.55. **Time and Place:** Monday 12:00, HS17, see 2.3.
Speaker: Davide Ravotti
Title: Horocycle flows on Abelian covers of hyperbolic surfaces
Abstract: The horocycle flow on the unit tangent bundle of a surface of constant negative curvature is the unit speed translation along the stable leaves of the geodesic flow. When the surface is compact or of finite volume, its qualitative (as well as, to a good extent, its quantitative) ergodic properties are well-understood. In this talk, I will focus on the infinite volume case, in particular I will discuss a joint work in progress with Livio Flaminio on mixing properties of horocycle flows on Abelian covers of compact surfaces.

Presentation 4.56. **Time and Place:** Thursday 16:30, HS17 (online), see 2.3.
Speaker: Marianne Rydzek
Title: New asymptotic invariants for mesure preserving vector fields.
Abstract: Given a non-singular vector field X preserving a measure μ on $\mathbb{S}^3$, can we construct invariants up to μ-preserving diffeomorphisms? In this talk I will present the most famous invariant of this kind, helicity, and explain its connection with the linking number of knots. Then I will introduce two new asymptotic invariants which also arise from knot theory : the trunkenness defined by Dehornoy-Rechtman and the bridge number of vector fields.

Presentation 4.57. **Time and Place:** Friday 11:30, HS13, see 2.3.
Speaker: Paweł Walczak
Title: Transverse entropy of foliated IFS's
Abstract: We shall introduce the notion of transverse entropy for families of maps preserving a foliation and we shall discuss some properties of such entropy. The notion itself comes from compilation of the two: (1) entropy of groups and semigroups of transformations of topological (metric) spaces and (2) that of foliations (in the sense of Ghys-Langevin-W.).

4.5 Geometric Group Theory

Presentation 4.58. **Time and Place:** Monday 9:00, HS13, see 1.
Speaker: Sebastian Hensel
Title: Fine Curve Graphs and Surface Homeomorphisms
Abstract: The curve graph is a well-studied and useful tool to study 3-manifolds and mapping class groups of surfaces. The fine curve graph is a recent variant on which the full homeomorphism group of a surface acts in an interesting way. In this talk we discuss some recent results which highlight behaviour not encountered in the "classical" curve graph. In particular, we will discuss the first entries in a dictionary between properties from surface dynamics and geometric properties of the action (and, while doing so, construct homeomorphisms acting parabolically). This is joint work with Jonathan Bowden, Katie Mann, Emmanuel Militon and Richard Webb.

Presentation 4.59. **Time and Place:** Tuesday 10:30, HS16 (online), see 2.4.
Speaker: Oussama Bensaid
Title: Coarse embeddings and homological filling functions
Abstract: Introduced by Gromov in the 80's, coarse embeddings are a generalization of quasi-isometric embeddings when the control functions are not necessarily affine. We will be particularly

interested in the obstructions to the existence of such embeddings between symmetric spaces of noncompact type, Euclidean buildings, CAT(0) spaces and mapping class groups. We show that, like in the quasi-isometric case, the rank is monotonous under coarse embeddings, provided that there is no Euclidean factor in the domain, or a Euclidean factor of dimension 1. The proof involves higher homological filling functions.

Presentation 4.60. **Time and Place:** Tuesday 16:00, HS16, see 2.4.
Speaker: Michael Brandenbursky
Title: L^p-geometry of diffeomorphism groups: old and new results
Abstract: In this talk I will discuss a number of old and new results on the large-scale geometry of the L^p-metrics on the group of area-preserving diffeomorphisms of each orientable surface. In particular, I will show how to use in a key way the Fulton-MacPherson type compactification of the configuration space of n points on the surface, due to Axelrod-Singer and Kontsevich, in order to apply the Schwarz-Milnor lemma to configuration spaces, a natural approach which is carried out successfully for the first time.

As sample results, I will show that all right-angled Artin groups admit quasi-isometric embeddings into the group of area-preserving diffeomorphisms endowed with the L^p-metric, and that all Gambaudo-Ghys quasi-morphisms on this metric group coming from the braid group on n strands are Lipschitz. This was conjectured to hold, yet proven only for low values of n and the genus g of the surface. (joint work with M. Marcinkowski and E. Shelukhin)

Presentation 4.61. **Time and Place:** Monday 10:30, HS13, see 2.4.
Speaker: Benjamin Brück
Title: High-dimensional rational cohomology of $SL^n(\mathbb{Z})$
Abstract: In joint work with Miller-Patzt-Sroka-Wilson, we show that the rational cohomology of $\mathrm{SL}_n(\mathbb{Z})$ vanishes in codimension two, i.e. $H^{\binom{n}{2}-2}(\mathrm{SL}_n(\mathbb{Z});\mathbb{Q}) = 0$ for all $n \geq 3$. This generalises work of Lee-Szarba and Church-Putman. In order to prove our result, we use Borel-Serre duality that relates these cohomology groups to the homology of the associated Tits building. We construct an explicit partial resolution of the Steinberg module for $\mathrm{SL}_n(\mathbb{Z})$ using building-like simplicial complexes.

https://arxiv.org/abs/2204.11967

Presentation 4.62. **Time and Place:** Wednesday 11:30, HS16, see 2.4.
Speaker: Francesco Fournier-Facio
Title: Braided Thompson groups and their quasimorphisms
Abstract: Braided Thompson groups are very interesting examples in geometric group theory. They arise as left-orderable groups with combinations of interesting property, but also as subgroups of the mapping class group of the plane minus a Cantor set. Since they are built out of braid groups and Thompson groups, when trying to establish a property it is often not clear which side will prevail. We explore quasimorphisms of some braided Thompson groups, and see that by slightly changing the groups we can drastically modify their behaviour, so that some of these groups conform to the braid part, and others to the Thompson part. Joint with Yash Lodha and Matthew Zaremsky.

Presentation 4.63. **Time and Place:** Thursday 14:30, HS11, see 2.4.

Speaker: Dominik Francoeur
Title: Lamplighter groups and bireversible automata
Abstract: Bireversible automata are combinatorial objects that can be used to describe groups with self-similar actions on rooted trees. Groups defined by bireversible automata are interesting from the point of view of group theory, since they have connections, among others, with $CAT(0)$ square complexes and commensurators of free groups in the automorphism groups of regular trees. However, currently, very few examples of such groups are known and finding more is the subject of active research. In this talk, after reviewing the necessary notions, we will show that every group of the form $A \wr \mathbb{Z}$ with A finite and abelian can be generated by a bireversible automaton, thus generalising a result of Skipper and Steinberg.

Presentation 4.64. **Time and Place:** Tuesday 11:30, HS16 (online), see 2.4.
Speaker: Adélie Garin
Title: Topological Data Analysis meets Geometric Group Theory: Stratifying the space of barcodes using Coxeter complexes
Abstract: At the intersection of data science and algebraic topology, topological data analysis (TDA) is a recent field of study, which provides robust mathematical, statistical and algorithmic methods to analyze the topological and geometric structures underlying complex data. TDA has proved its utility in many applications, including biology, material science and climate science, and it is still rapidly evolving. Barcodes are frequently used invariants in TDA.

They provide topological summaries of the persistent homology of a filtered space. Understanding the structure and geometry of the space of barcodes is hence crucial for applications.

In this talk, we use Coxeter complexes to define new coordinates on the space of barcodes.These coordinates define a stratification of the space of barcodes with n bars where the highest dimensional strata are indexed by the symmetric group. This creates a bridge between the fields of TDA, geometric group theory and permutation statistics, which could be exploited by researchers from each field.

This presentation is based on joint work with B. Brück. No prerequisite on TDA or Coxeter complexes are required.

Presentation 4.65. **Time and Place:** Thursday 15:00, HS11, see 2.4.
Speaker: Jonah Gaster
Title: Boundary slopes for the Markov ordering on relatively prime integer pairs"
Abstract: A rational number p/q determines a simple closed curve on a once-punctured torus. When the torus is endowed with a complete hyperbolic metric, each rational gets a well-defined length. If the metric is chosen so that the torus is "modular" (that is, when its holonomy group is conjugate into PSL(2,Z)), the lengths of the curves have special arithmetic significance with connections to Diophantine approximation and number theory. Taking inspiration from McShane's elegant proof of Aigner's conjectures, concerning the (partial) ordering of the rationals induced by hyperbolic length on the modular torus, I will describe how hyperbolic geometry can be used to characterize monotonicity of the order so obtained along lines of varying slope in the (q, p)-plane.

Presentation 4.66. **Time and Place:** Monday 12:00, HS13, see 2.4.
Speaker: Annette Karrer

Title: Connected components of Morse boundaries of graph of groups
Abstract: Each finitely generated group G has a topological space associated to it called the Morse boundary. This boundary generalizes the Gromov boundary of Gromov-hyperbolic groups and captures how similar the group is to a Gromov-hyperbolic group.

Let G be a graph of groups where the edge groups are undistorted and do not contribute to the Morse boundary of G. I will explain why then each connected component of the Morse boundary with at least two points originate from the Morse boundary of a vertex group. This is joint work with Elia Fioravanti.

Presentation 4.67. **Time and Place:** Tuesday 17:00, HS16 (online), see 2.4.
Speaker: Srivatsav Kunnawalkam Elayavalli
Title: Co-meager isomorphism classes in spaces of enumerated groups
Abstract: I will present joint work with I. Goldbring and Y. Lodha where we study the space of enumerated groups which is a topological Polish space consisting of enumerations of countable groups. We also study Polish subspaces of this space consisting of groups with desired properties. There is a fundamental problem of existence of co-meager isomorphism classes in these spaces. We settle this problem for a family of subspaces including the space of all countable enumerated groups and the space of all left orderable enumerated groups. Our work crucially uses tools from combinatorial group theory and work of Hodges on model theoretic forcing.

Presentation 4.68. **Time and Place:** Wednesday 10:30, HS16, see 2.4.
Speaker: Waltraud Lederle
Title: Boomerang subgroups and the Stuck-Zimmer theorem
Abstract: We introduce the notion of boomerang subgroups of a discrete group. Those are subgroups satisfying a strong recurrence property, when we consider them as elements of the space of all subgroups with the conjugation action. We prove that every boomerang subgroup of $\mathrm{SL}_n(\mathbb{Z})$ for $n \geq 3$ is finite or of finite index. Thus we give a new proof of the Stuck-Zimmer rigidity theorem for $\mathrm{SL}_n(\mathbb{Z})$ avoiding almost all measure theory. This is joint work with Yair Glasner.

Presentation 4.69. **Time and Place:** Tuesday 18:00, HS11 (online), see 2.4.
Speaker: Jone Lopez de Gamiz Zearra
Title: Subgroups of right-angled Artin groups
Abstract: In general, subgroups of right-angled Artin groups (RAAGs for short) are known to have a wild structure and bad algorithmic behaviour. In this talk we will see that restricting to important families of RAAGs, however, assures a tame subgroup structure that leads to good algorithmic behaviour.

First of all, we will discuss finitely generated normal subgroups of RAAGs. A classical result of Greenberg states that non-trivial finitely generated normal subgroups of free groups are of finite index. We will generalise this result to the class of RAAGs and show that finitely generated normal subgroups of RAAGs are virtually co-abelian. We will then discuss some algorithmic consequences such as the decidability of the conjugacy and the membership problems for these subgroups.

Secondly, we will recall some results on subgroups of direct products of free groups developed by Baumslag-Roseblade and Bridson-Howie-Miller-Short and we will explain how they generalise to other classes of RAAGs such as coherent RAAGs.

This is joint work with Montserrat Casals-Ruiz (University of the Basque Country UPV/EHU).

Presentation 4.70. **Time and Place:** Wednesday 12:00, HS16 (online), see 2.4.
Speaker: Justin Moore
Title: Subgroups of $PL + I$ which do not embed into Thompson's group F
Abstract: We give a general criterion — the existence of an *F-obstruction* — for showing that a subgroup of $PL + I$ does not embed into Thompson's group F. An immediate consequence is that Cleary's *golden ratio group* F_τ does not embed into F, answering a question of Burillo, Nucinkis, and Reves. Our results also yield a new proof that Stein's groups Fp,q do not embed into F, a result first established by Lodha using his theory of coherent actions. This is joint work with James Hyde.

Presentation 4.71. **Time and Place:** Tuesday 11:00, HS16, see 2.4.
Speaker: Thomas Ng
Title: Residually finite quotients of free products
Abstract: Small cancellation theory is a rich source of cocompactly cubulated groups. The classical $C'(1/6)$ condition has a natural generalization to quotients of free products. These quotients act on a Gromov hyperbolic polygonal complexes and have been used to exhibit infinite families of groups with exotic embedding properties. When the factor groups are assumed to act geometrically on a CAT(0) cube complex, Martin and Steenbock show that such $C'(1/6)$ quotients are again cocompactly cubulated. I will describe joint work with Eduard Einstein (University of Pittsburgh) proving that when the free factors are residually finite any $C'(1/6)$ quotient is again residually finite. Our proof relies on showing that the quotient groups are relatively cubulated.

Presentation 4.72. **Time and Place:** Tuesday 16:30, HS16, see 2.4.
Speaker: Catherine Pfaff
Title: Typical Trees: An $Out(F_r)$ Excursion
Abstract: Answering questions posed by Bestvina, Handel, and Mosher, we prove which properties are held by random outer automorphisms of free groups and points in the boundary of Culler-Vogtmann outer space. This is joint work with Ilya Kapovich (Hunter College), Joseph Maher (CUNY), and Samuel J. Taylor (Temple University).

Presentation 4.73. **Time and Place:** Wednesday 11:00, HS16, see 2.4.
Speaker: Yuri Santos Rego
Title: Fixed points, Reidemeister numbers, and cohomology
Abstract: Fixed-point results are of paramount importance in multiple areas, and Reidemeister numbers of group automorphisms turn out to be particularly useful to establish the existence (or not) of fixed points of related maps. In this talk I will explain how group cohomology comes into play in those investigations. As an application, we shall obtain qualitative information about automorphisms of many F-like groups, that is, groups of homeomorphisms resembling Richard Thompson's famous group F. Based on joint work with Paula M. Lins de Araujo (University of Lincoln, UK) and Altair S. de Oliveira-Tosti (UENP, Brazil).

Presentation 4.74. **Time and Place:** Monday 11:30, HS13, see 2.4.
Speaker: Bakul Sathaye

Title: Obstructions to Riemannian smoothing of non-positively curved manifolds
Abstract: In this talk I will discuss obstructions to having a smooth Riemannian metric with non-positive sectional curvature on a locally CAT(0) manifold. I will briefly discuss a knotting obstruction in dimension 4 and explain why this obstruction does not work in higher dimensions. I will then discuss a large scale quasi-isometry invariant of pairs of spaces (X, Y) called the 'fundamental group of the Y-end' and show how it can be used to give a coarse knotting obstruction to Riemannian smoothings in higher dimensions. This is joint work with Jean-Francois Lafont.

Presentation 4.75. **Time and Place:** Monday 11:00, HS13, see 2.4.
Speaker: Mireille Soergel
Title: Dyer groups are $CAT(0)$
Abstract: When studying the solution to the word problem in Coxeter groups and in graph products of cyclic groups, one might notice that they are the same. Tits and Green both show that a word is reduced if and only if it cannot be reduced by a series of elementary M-transformations. Matthew Dyer described a class of groups, which we call Dyer groups, which are characterized by such a solution to the word problem. This class includes, but is not limited to, Coxeter groups, right angled Artin groups, and graph products of finite cyclic groups. We will introduce Dyer groups by giving their standard presentation and give some of their properties.

Presentation 4.76. **Time and Place:** Tuesday 17:30, HS11 (online), see 2.4.
Speaker: Chenxi Wu
Title: Fibered cones and sphere complex translation lengths
Abstract: This is a collaboration with Harry Baik and Dongyurl Kim. We studied the upper bound of translation lengths on sphere complexes induced by self maps on closed manifolds and use them to study $Out(F_n)$ actions on free factor and free splitting complexes as well as handlebody groups. I will cover materials in arXiv:2107.09018 as well as further results in an upcoming paper.

Presentation 4.77. **Time and Place:** Tuesday 12:00, HS16, see 2.4.
Speaker: Richard Wade
Title: The automorphism group of the free group of rank two and the five-punctured sphere.
Abstract: The abstract commensurator of a group G is the group of isomorphisms between finite-index subgroups of G, where two isomorphisms are considered equal if they agree on a common finite-index subgroup of their domains. We shall briefly survey existing results about abstract commensurators of automorphism groups of free groups and give geometric reasoning behind the following, initially surprising, fact: the abstract commensurator of the automorphism group of a free group of rank two is equal to the extended mapping class group of the five-punctured sphere. This is based on forthcoming work with Martin Bridson.

4.6 Set-Theoretic Topology

Presentation 4.78. **Time and Place:** Thursday, 9:00, HS13, see 1.
Speaker: Leandro Aurichi
Title: A characterization of productive cellularity
Abstract: We present a characterization for when a ccc space X is such that $X \times Y$ is ccc, for

any ccc space Y. We extend this and investigate all the "cellular spectrum" of a space $X : Sp(X) = \{\kappa \geq \aleph_0 : \forall\, Y c(Y) \leq \kappa \Rightarrow c(X \times Y) \leq \kappa\}$, where $c(X)$ is the cellularity of X. This is a joint work with Lucia Junqueira and Renan Mezabarba.

Presentation 4.79. **Time and Place:** Tuesday 17:00, HS17, see 2.5.
Speaker: T. M. G. Ahsanullah
Title: Monads and their Eilenberg-Moore categories of the categories of enriched lattice-valued convergence spaces
Abstract: In 2012, Jäger first pointed out that the category of convergence approach spaces, **CAP** is simultaneously a reflective and coreflective subcategory of the category of enriched lattice-valued convergence spaces, L-**CONV**; this stimulates much interest to look into various aspects of these categories. Following the category of convergence approach transformation monoids, as introduced by Colebunders et al., we proved that the category of convergence approach transformation groups, **CAPTGRP** is isomorphic to a reflective subcategory of the category of enriched lattice-valued convergence transformation groups, L-**CONVTGRP**. In this talk our motivations are to construct various monads and their associated algebras on three types of subcategories stemmed from
(a) the category of enriched lattice-valued convergence spaces, L-**CONV** [Jäger, 2012; Orpen-Jäger, 2012];
(b) the category of convergence approach spaces, **CAP** [Lowen, 1997];
(c) the category of probabilistic convergence spaces under t-norm, $\mathbf{PCONV}_t$ [Herrlich-Zhang, 1998].
Specifically, constructing a monad $\mathbb{F}$ on $\mathfrak{C} := L$-**CONVGRP**$\times L$-**CONV**, where L-**CONVGRP** denotes the category of enriched lattice-valued convergence groups, we show that the category L-**CONVTGRP** over $\mathfrak{C}$ is isomorphic to $\mathfrak{C}^{\mathbb{F}}$ - the category of Eilenberg-Moore algebras. In this way, one can achieve other monads related to (b) and (c), respectively. Finally, we are interested to find possible relationship between the monads, and their corresponding Eilenberg-Moore categories.

Presentation 4.80. **Time and Place:** Monday 17:00, HS14, see 2.5.
Speaker: Collins Amburo Agyingi
Title: When is a quasi-uniformly continuous real-valued function on a quasi-uniform space bounded?
Abstract: It is well known that all quasi-uniformly continuous real-valued functions on a totally bounded quasi-uniform space are bounded. Note however that there exist quasi-uniform spaces with this property that are not totally bounded, that is, a quasi-uniform space with no unbounded quasi-uniformly continuous functions need not be totally bounded. In this talk, we give a necessary and sufficient condition that will allow all quasi-uniformly continuous real-valued functions on a quasi-uniform space to be bounded. We conclude the talk by giving analogous results for quasi-proximity spaces.

Presentation 4.81. **Time and Place:** Thursday 11:30, HS13, see 2.5.
Speaker: Sergey Antonyan
Title: Gromov-Hausdorff Hyperspaces of $\mathbb{R}^n$
Abstract: Let (M, d) be a metric space. For two non-empty subsets A, $B \subset M$, the Hausdorff distance $d_H(A, B)$ is defined as follows: $d_H(A, B) = \max\{\sup_{a\in A} d(a, B),\ \sup_{b\in B} d(b, A)\}$, where $d(x, C) = \inf\{d(x, c) \mid c \in C\}$. The set of all non-empty compact subsets of M is denoted by 2^M and is endowed with the Hausdorff metric d_H. The pair $(2^M, d_H)$ is called the hyperspace of M.

For two compact metric spaces X and Y, their Gromov-Hausdorff distance $d_{GH}(X,Y)$ is defined to be the infimum of all real numbers $r>0$ such that here exist a metric space (M,d) and isometric embeddings $i:X\hookrightarrow M$ and $j:Y\hookrightarrow M$ with the Hausdorff distance $d_H(i(X),j(Y))$ less than r. It is a useful tool for studying topological properties of families of metric spaces. Clearly, the Gromov-Hausdorff distance between two isometric spaces is zero; it is a metric on the family $\mathbb{GH}$ of isometry classes of compact metric spaces. The metric space $(\mathbb{GH},\mathrm{d_{GH}})$ is called the Gromov-Hausdorff space.

In this talk we mainly are interested in the subspace $\mathbb{GH}(\mathbb{R}^n)$ of $\mathbb{GH}$ consisting of the classes $[E]\in\mathbb{GH}$ whose representative E is a metric subspace of the standard Euclidean space $\mathbb{R}^n$, $n\geq 1$. $\mathbb{GH}(\mathbb{R}^n)$ is called the Gromov-Hausdorff hyperspace of $\mathbb{R}^n$. One of the main results of this talk asserts that $\mathbb{GH}(\mathbb{R}^n)$ is homeomorphic to the orbit space $2^{\mathbb{R}^n}/E(n)$, where $2^{\mathbb{R}^n}$ is the hyperspace of all non-empty compact subsets of $\mathbb{R}^n$ endowed with the Hausdorff metric, and $E(n)$ is the isometry group of $\mathbb{R}^n$. This is applied to prove that $\mathbb{GH}(\mathbb{R}^n)$ is homeomorphic to the punctured Hilbert cube $[0,1]^{\aleph_0}\setminus\{*\}$.

Presentation 4.82. **Time and Place:** Thursday 12:00, HS13, see 2.5.
Speaker: Serhii Bardyla
Title: Open filters and measurable cardinals
Abstract: In this presentation we discuss the poset $OF(X)$ of all free open filters on a given Hausdorff space X. We characterize spaces whose posets of free open filters are lattices. For each $n\in\mathbb{N}$ we construct a scattered space X such that $OF(X)$ is order isomorphic to the n-element chain. This result answers two questions of Mooney. It is proved that the existence of a space X which possesses a free ω_1-complete open ultrafilter is equivalent to the existence of a measurable cardinal. This provides an answer to an old question of Liu. Assuming the existence of n measurable cardinals, we construct a space X such that $OF(X)$ is isomorphic to $2n+1$. Our research motivates a new stratification of ultrafilters on κ which is defined with a help of scattered subspaces of $\beta(\kappa)$. Some properties (related to measurable cardinals) of this stratification will be revealed. This is a joint work with J. Šupina and L. Zdomskyy.

Presentation 4.83. **Time and Place:** Wednesday 12:00, HS17, see 2.5.
Speaker: Pratulananda Das
Title: Generating subgroups of the circle using a generalized class of density functions
Abstract: In this talk, we consider the generalized version dfg of the natural density function where $g:\mathbb{N}\to[0,\infty)$ satisfies $g(n)\to\infty$ and $\frac{n}{g(n)}\not\to 0$ whereas f is an unbounded modulus function and generate versions of characterized subgroups of the circle group $\mathbb{T}$ using these density functions. We show that these subgroups have the same feature as the s-characterized subgroups [Dikranjan, Das, Bose, Fund. Math., 2020] and our results provide more general versions of the main results of that article. But at the same time the utility of this more general approach is justified by constructing new and nontrivial subgroups for suitable choice of f and g. In several of our results we use properties of the ideal $\mathcal{Z}_g(f)$ which are first presented along with certain new observations about these ideals which were not there in [Bose, Das, Kwela, Indag. Math., 2018]

Presentation 4.84. **Time and Place:** Friday 11:30, HS16, see 2.5.
Speaker: Davide Giacopello

Title: On set (strongly) star Menger
Abstract: Let $\mathcal{U}$ be a cover of a space X and A be a subset of X; the star of A with respect to $\mathcal{U}$ is the set $st(A,\mathcal{U}) = \bigcup\{U : U \in \mathcal{U} \text{ and } U \cap A \neq \emptyset\}$. In this talk we consider some recent relative star versions of Menger property and the corresponding Hurewicz-type, called *set (strongly) star Menger* and *set (strongly) star Hurewicz*, introduced by Kočinac, Konca and Singh. We show that the *set strongly star Menger* and *set strongly star Hurewicz* are between countable compactness and the property of having countable extent. Also we study the behavior of all this properties with respect the product with a compact space. Among other things we answer to some recent questions posed by Kočinac, Konca and Singh.

This is a joint work with M. Bonanzinga and F. Maesano.

Presentation 4.85. **Time and Place:** Tuesday 16:00, HS17, see 2.5.
Speaker: Ivan Gotchev
Title: Cardinal inequalities with Shanin number and π-character
Abstract: We recall that a regular cardinal number κ is a caliber of a topological space X if for any family $\mathcal{U}$ of non-empty open subsets of X such that $|\mathcal{U}| = \kappa$, there exists a family $\mathcal{V} \in [\mathcal{U}]^\kappa$ such that $\bigcap \mathcal{V} \neq \emptyset$. The cardinal number $sh(X) = \min\{\kappa \geq \omega : \kappa^+ \text{ is a caliber of } X\}$ is called the Shanin number of the space X. It is easy to see that $c(X) \leq sh(X) \leq d(X)$ for any space X.

In this talk we will present some cardinal inequalities involving the Shanin number and the π-character $\pi\chi(X)$ of a space X. Among other results we will show that, under GCH, for every Hausdorff space X we have $|X| \leq sh(X)^{\pi\chi(X)\psi_c(X)}$ and therefore $|X| \leq sh(X)^{\chi(X)}$. These give, under GCH, formal generalizations of the Willard–Dissananyake's inequality $|X| \leq d(X)^{\pi\chi(X)\psi_c(X)}$ and of Pospišil's inequality $|X| \leq d(X)^{\chi(X)}$, which are true for every Hausdorff space X. In addition, if X is a regular T_1-space, and GCH holds, then $d(X) \leq sh(X)^{\pi\chi(X)t(X)}$.

This is a joint work with Vladimir Tkachuk.

Presentation 4.86. **Time and Place:** Thursday 11:00, HS13, see 2.5.
Speaker: Sang-Eon Han
Title: Many types of digital connectivities derived from some Alexandroff topologies on Zn
Abstract: Recently, countably many kinds of Alexandroff topologies $(T_k, k \in \mathbb{Z})$ and $(T'_k, k \in \mathbb{Z})$ have been established on $\mathbb{Z}$.
In this talk, we will show that for each nonzero integers k, the topologies T_k, T'_k, T_{-k}, and T'_{-k} are homeomorphic. The adjacency relations induced by the product topologies $(T_k)^n$ and $(T'_k)^n$ are investigated and compared with the adjacency derived from the n-dimensional Khalimsky topological space. Besides, we also show that the adjacency relations induced by T_k, T'_k, T_{-k}, and T'_{-k} are isomorphic. Then, note that the adjacency relations on $\mathbb{Z}$ induced by these topologies, $k \neq 0$, are different from each other, which makes the earlier works more advanced.
Based on this approach, we will show some strong advantages of taking a suitable adjacency of $\mathbb{Z}^n$ according to our needs. Thus we can apply this approach into digital image processing, mathematical morphology, and so on.

Presentation 4.87. **Time and Place:** Wednesday 11:00, HS17, see 2.5.
Speaker: Mouadi Hassan
Title: A topological study on an infinite product of quasi-local rings

Abstract: We describe classes of prime ideals in a product of commutative rings with a topological approach. We consider in particular prime ideals in the infinite product of quasi-local rings. Special attention is paid to maximal ideals.

Presentation 4.88. **Time and Place:** Tuesday 17:00 HS17 , see 2.5.
Speaker: Aura Lucina Kantún-Montiel
Title: G-maps over the homogeneous space G/H as equivariant fibrations
Abstract: By a G-fibration, we mean the equivariant version of a Hurewicz fibration, that is, a G-map having the equivariant homotopy lifting property with respect to all G-spaces. G-fibrations arise in equivariant theory quite naturally, one of the classical results states that if H is a closed subgroup of a compact Lie group G, then any G-map $q : E \to G/H$ is a G-fibration.

A natural question is whether this result remains valid when working with a non-compact or non-Lie acting group. To answer this, we are going to give generalizations of some classical results that lead us to prove that p is also a G-fibration whenever G is a (not necessarily compact) Lie group or an almost connected metrizable group and H its compact subgroup. In fact, we have a more general result: If $p : E \to B$ is an H-fibration, then the G-map induced by the twisted product functor $G \times_H E \to G \times_H B$ is a G-fibration.

Presentation 4.89. **Time and Place:** Friday 11:00, HS16 (online), see 2.5.
Speaker: Fortunato Maesano
Title: Set versions of star compact and star Lindelöf properties
Abstract: Given a topological space X and an open cover $\mathcal{U}$ of it, the star of a subset A of X with respect to $\mathcal{U}$ is the set $st(A,\mathcal{U}) = \bigcup\{U \in \mathcal{U} : U \cap A \neq \emptyset\}$. For a space, the properties to be covered by stars founded on a finite or a countable subset of the cover are called star compact and star Lindelöf properties, both are weaker than countable compactness and stronger than their pseudo covering property counterpart. We present a new class of star covering properties, namely the set star covering properties, wich were introduced by Kočinac, Konca and Singh, and consist on a generalization both of the previously cited ones and other already known. This is a joint work with M. Bonanzinga (University of Messina).

Presentation 4.90. **Time and Place:** Monday 16:00, HS14, see 2.5.
Speaker: Andrea Medini
Title: Zero-dimensional σ-homogeneous spaces
Abstract: All spaces are assumed to be separable and metrizable. Ostrovsky showed that every zero-dimensional Borel space is σ-homogeneous. Inspired by this theorem, we obtained the following results: (1) Assuming AD, every zero-dimensional space is σ-homogeneous, (2) Assuming AC, there exists a zero-dimensional space that is not σ-homogeneous, (3) Assuming $\mathsf{V} = \mathsf{L}$, there exists a coanalytic zero-dimensional space that is not σ-homogeneous. Along the way, we will discuss a notion of hereditary rigidity. It is an open problem whether every analytic zero-dimensional space is σ-homogeneous. This is joint work with Zoltán Vidnyánszky.

Presentation 4.91. **Time and Place:** Monday 16:30 HS14 (online), see 2.5.
Speaker: Justin Moore
Title: On the additivity of strong homology for locally compact second countable spaces
Abstract: Recently Bergfalk and Lambie-Hanson showed that in the weakly compact Hechler

model, the higher derived limits $\lim^n \boldsymbol{A}$ vanish for all n, where $\boldsymbol{A}$ is a certain inverse system of abelian groups indexed by ω^ω. We generalize this result and use it to show that in the weakly compact Hechler model, strong homology is additive for the class of locally compact second countable spaces.

Presentation 4.92. **Time and Place:** Wednesday 10:30, HS17, see 2.5.
Speaker: Peter Nyikos
Title: Answers for functionally countable compacta
Abstract: A *functionally countable space* is one on which every continuous real-valued function has countable range. In this year's STDC, and in a recent paper, Vladimir Tkachuk posed 14 questions having to do with spaces X such that $X^2 \setminus \Delta_X$ is functionally countable. This talk gives a simple example of a space that answers the following question:

Question 4.10. Is there a ZFC example of a non-metrizable compact space X such that $(X \times X)\setminus\Delta_X$ is functionally countable?

The following example is chosen for easy visualizability. X2 has the open unit square as the underlying set, while $(X \cup \infty)^2$ can be thought of as $(0,1]^2$ with a very different topology.

Example. Let X be the open unit interval $(0,1)$, with the following topology. Let $Q = \mathbb{Q} \cap (0,1)$ be a dense set of isolated points, and let each $p \in X \setminus Q$ have a base of neighborhoods consisting of p together with the tails of an ascending sequence of points q_n of Q.

Theorem. Let $X + 1$ denote the one-point compactification of X. Then $(X+1)^2 \setminus \Delta_{X+1}$ is functionally countable. There is also a ZFC example that solves Tkachuk's Questions 4.1 through 4.8 that will be described.

Presentation 4.93. **Time and Place:** Friday 10:30, HS16 (online), see 2.5.
Speaker: Evgenii Reznichenko
Title: Extension of mappings to non-Tychonoff spaces
Abstract: Let X and Y be countably compact spaces, Z be a space, and $f : X \times Y \to Z$ be a separately continuous mapping. If Z is a Tychonoff space, then there is a compact extension bX of X, such that the mapping f extends to a separately continuous mapping $\hat{f} : bX \times Y \to \beta Z$, where βZ is the Stone–Cech compactification of Z. The paper discusses under what conditions there exist extensions bX and bZ of the spaces X and Y, respectively, such that the mapping f extends to a separately continuous mapping $\hat{f} : bX \times Y \to bZ$. The application of the obtained results to the problem of continuity of operations in groups with topology is considered.

Presentation 4.94. **Time and Place:** Tuesday 14:30, HS17, see 2.5.
Speaker: Tom Richmond
Title: Complements of topologies with short specialization quasiorders
Abstract: By identifying a topology τ on a finite set X with its specialization quasiorder, we investigate the complements of τ in the lattice of topologies on X in cases where the heights of the specialization quasiorders are small.

Presentation 4.95. **Time and Place:** Thursday 10:30, HS13, see 2.5.
Speaker: Salvatore Scamperti

Title: Wadge Hierarchy on 0-dimensional Polish space
Abstract: Joint work with Raphaël Carroy (University of Turin) and Luca Motto Ros (University of Turin). Given two topological spaces X and Y, a continuous reduction from $A \subseteq X$ to $B \subseteq Y$ is a continous function $f : X \to Y$ satisfying $f^{-1}(B) = A$. In this case we say that A Wadge reduces to B. Wadge theory has received a lot of attention, but the complete description of the Wadge hierarchy, up to order-isomorphism, for all zero-dimensional spaces under AD had never been done. The purpose of the talk is to give such description.

Presentation 4.96. **Time and Place:** Wednesday 11:30, HS17, see 2.5.
Speaker: Olga Sipacheva
Title: Topological Groups with Strong Disconnectedness Properties
Abstract: There is a whole hierarchy of classical strong disconnectedness properties: a space X is *maximal* if it has no isolated points and any two disjoint subsets of X have disjoint closures; X is *extremally disconnected* if any two disjoint open subsets of X have disjoint closures (or, equivalently, the closure of any open set in X is open); X is *basically disconnected* if the closure of any cozero set in X is open; X an *F-space* if any two disjoint cozero sets are completely (=functionally) separated in X; and, finally, X is an F'-space if any two disjoint cozero sets in X have disjoint closures.

It is well known that all strong disconnectednesses badly affect homogeneity properties. Thus, it is natural to ask whether any of them can coexist with the property of being a topological group, which can be regarded as ultimate homogeneity. It is known that both the existence and nonexistence of nondiscrete maximal, as well as countable extremally disconnected, groups is consistent with ZFC. The existence problem for uncountable nondiscrete extremally disconnected, as well as for basically disconnected, F-, and F'-groups not being P-spaces, remains unsolved.

The talk is devoted to tological groups whose underlying spaces are basically disconnected, F-, or F'-spaces but not P-spaces. It is proved, in particular, that the existence of an Abelian basically disconnected group which is not a P-space is equivalent to the existence of a nondiscrete Boolean basically disconnected group of countable pseudocharacter. It is also proved that free and free Abelian topological groups of zero-dimensional non-P-spaces are never F'-spaces and that the existence of free Boolean F'-groups is equivalent to that of selective ultrafilters on ω.

Presentation 4.97. **Time and Place:** Friday 12:00, HS16, see 2.5.
Speaker: Corey Switzer
Title: Ultrafilters and Ideal Independent Families
Abstract: A family $\mathcal{I} \subseteq [\omega]^\omega$ is called *ideal independent* if for every $A \in \mathcal{I}$ and every finite $F \subseteq \mathcal{I} \setminus \{A\}$ we have $A \mathrel{**} \bigcup F$. In other words A is not in the ideal generated by $\mathcal{I} \setminus \{A\}$. The cardinal $\mathfrak{s}_{mm}$ is defined as the minimal size a of a maximal ideal independent family. In this talk we will discuss how this cardinal relates to other cardinal characteristics of extremal sets of reals. In particular we will show that $\mathfrak{s}_{mm}$ is independent the independence number $\mathfrak{i}$, but surprisingly, ZFC-provably greater than or equal to the ultrafilter number $\mathfrak{u}$. This is joint work with Jonathan Cancino and Vera Fischer.

Presentation 4.98. **Time and Place:** Tuesday 16:00, HS17, see 2.5.
Speaker: Franklin Tall
Title: New Topological Generalizations of Descriptive Set Theory and Applications to Selection

Principles
Abstract: This is joint work with Ivan Ongay Valverde. Descriptive Set Theory studies "definable" sets of reals and has many applications. Classically, Borel and analytic sets were studied, but the theory became difficult when people tried to extend it to the projective sets. However, determinacy axioms following from large cardinals gave a nice theory for the projective and even σ-projective sets. Recently, some set theorists have been generalizing Descriptive Set Theory by replacing ${}^{\omega}\omega$ (i.e., the space of irrationals) by ${}^{\kappa}\kappa$ for a regular cardinal κ. There are other generalizations, dating from the 1960's, which are topological in nature. In particular, several researchers defined *K-analytic* spaces in various equivalent ways, e.g. upper semi-continuous compact-valued images of the space of irrationals or continuous images of Lindelöf Čech-complete spaces. These spaces have found many applications in Functional Analysis. We study several different generalizations of K-analytic spaces, e.g. replacing the irrationals by σ-projective sets and assuming the Axiom of σ-Projective Determinacy. The *Definable Menger Conjecture* asserts that definable Menger spaces are σ-compact. A weaker version—true for example for Menger K-analytic spaces—is that they are Hurewicz. We investigate these conjectures for various of these generalizations, proving positive results, sometimes with the aid of determinacy axioms.

Presentation 4.99. **Time and Place:** Tuesday 15:00 HS17, see 2.5.
Speaker: Vesko Valov
Title: Extending homeomorphisms on Cantor cubes
Abstract: This is a joint paper with E. Shchepin. We discuss the question of extending homeomorphism between closed subsets of the Cantor discontinuum D^{τ}. It is established that any homeomorphism f between two closed subsets of D^{τ} can be extended to an autohomeomorphism of D^{τ} provided f preserves the λ-interiors of the sets for every cardinal λ. This is a non-metrizable analogue of the Ryl-Nardjewski theorem stating that if X is a proper closed subset of the Cantor set $D^{\aleph_0}$ and f is a homeomorphism of X onto $f(X)$ such that $f(\text{intX}) = \text{int f(X)}$, then there exists an autohomeomorphism of $D^{\aleph_0}$ extending f.

4.7 Topological Dynamics

Presentation 4.100. **Time and Place:** Tuesday 9:00, HS13 (online), see 1.
Semi-Plenary Speaker: Xiangdong Ye
Title: On the density of polynomial orbits in minimal systems
Abstract: A general question in ergodic theory or topological dynamical systems is that for which subset S of Z there is a point whose orbit along S is dense in the whole space, or the time averages of a function along S converge to its integral. In this talk, I will explain how one can show that for a totally minimal system and S being the values of a given integer polynomial on Z, such x exists. This result was developed gradually in the works by Huang-Shao-Ye, Glasner-Huang-Shao-Weiss-Ye, and Qiu.

Presentation 4.101. **Time and Place:** Friday 11:30, HS14, see 2.6.
Speaker: Héctor Barge
Title: Poincaré-Hopf's theorem and dynamics of isolated invariant compacta
Abstract: In this talk we characterize the total index of a vector field defined in an isolating

neighborhood in terms of the dynamics of the induced flow and the topology of the isolated invariant set. In this context some new versions of the Poincaré-Hopf theorem and Borsuk's antipodal theorem are given. We also see that if the isolated invariant set is non-saddle some nice consequences of these connections can be derived. This is joint work with J.M.R. Sanjurjo (Universidad Complutense de Madrid).

Presentation 4.102. **Time and Place:** Thursday 15:00, HS16 see 2.6.
Speaker: Piotr Bartłomiejczyk
Title: Expanding Lorenz maps with slope greater than $\sqrt{2}$ are leo
Abstract: We prove that expanding Lorenz maps with slope greater than $\sqrt{2}$ are locally eventually onto (leo). To be more precise, recall that an expanding Lorenz map is a map $f\colon [0,1] \to [0,1]$ satisfying the following three conditions: (1) there is a critical point $c \in (0,1)$ such that f is continuous and strictly increasing on $[0,c)$ and $(c,1]$, (2) $\lim_{x\to c^-} f(x) = 1$ and $\lim_{x\to c^+} f(x) = f(c) = 0$, (3) f is differentiable for all points not belonging to a finite set $F \subset [0,1]$ and there is $\lambda > 1$ such that $\inf\{f'(x) \mid x \in [0,1] \setminus F\} \geq \lambda$. Assume that f is an expanding Lorenz map and $\beta = \inf\{f'(x) \mid x \in [0,1] \setminus F\}$. Let $f_0(x) = \sqrt{2}x + \frac{2-\sqrt{2}}{2} \pmod 1$. Then if $\beta \geq \sqrt{2}$ and $f \neq f_0$ then for every nonempty open subinterval $J \subset (0,1)$ there exists $n \in \mathbb{N}$ such that $f^n(J) \supset [0,1)$. This is joint work with Piotr Nowak-Przygodzki.

Presentation 4.103. **Time and Place:** Thursday 14:30, HS16, see 2.6.
Speaker: Andrzej Biś
Title: Variational principles of a sequence of maps
Abstract: The authors of [1] have applied Convex Analysis approach to get a general variational principle. In a case of a sequence of continuous self-maps, there are several entropy-like quantities that lead to several pressure functions. In the talk, I intend to present the applications of the results of [1] to get the variational principles of a sequence of continuous self-maps. A presentation is based on [1] and a joint work with A. Marczuk.

References

[1] Andrzej Biś, Maria Carvalho, Miguel Mendes, Paulo Varandas, *A convex analysis approach to entropy functions, variational principles and equilibrium states*, to appear in Commun. Math. Phys.

Presentation 4.104. **Time and Place:** Tuesday 11:00, HS13, see 2.6.
Speaker: Matúš Dirbák
Title: Minimal extensions of smooth dynamical systems"
Abstract: A classical result of Fathi and Herman states that a smooth compact connected manifold Z without boundary admitting a locally free action of $\mathbb{T}^1$ (respectively, an almost free action of $\mathbb{T}^2$) admits a minimal diffeomorphism (respectively, a minimal flow $\mathbb{R} \curvearrowright Z$). Proofs of these results rely on a variation of the approximation by conjugation method which is due to Anosov and Katok. In the first part of our talk we will give examples of manifolds Z satisfying the assumptions formulated above in the class of homogeneous spaces of compact connected Lie groups. In the second part

we will be interested in the existence of minimal skew products over minimal flows having a free cycle. We say that a minimal flow $\mathcal{F} : \Gamma \curlyvee X$, whose acting group Γ is a connected Lie group and the phase space X is a compact manifold, has a free cycle if $rank(im(f)) < rank(H_1^w(X))$, where $f : H_1^w(\Gamma) \to H_1^w(X)$ is the morphism induced by a transition map of $\mathcal{F}$ and $H_1^w(\Gamma), H_1^w(X)$ are the first weak homology groups of Γ, X, respectively (these are obtained from the ordinary homology groups by factoring out their torsion subgroups).
We show that if X and $\mathcal{F}$ are smooth/analytic, $\mathcal{F}$ has a free cycle and $\ell \in \mathbb{N}$ then $\mathcal{F}$ has an abundance (in the algebraic sense) of minimal group extensions with the fibre $\mathbb{T}^\ell$ which are also smooth/analytic. We use this result together with ideas of Fathi and Herman to show that such flows admit minimal smooth skew products with the fibre Z being a compact manifold admitting an almost free action of $\mathbb{T}^2$.
In the last part of our talk we will give examples of minimal flows with free cycles, mostly in the class of homogeneous flows of connected Lie groups (which are analytic).

Presentation 4.105. **Time and Place:** Thursday 16:30, HS16, see 2.6.
Speaker: Till Hauser
Title: Pure point diffraction and entropy beyond the euclidean space
Abstract: For euclidean pure point diffractive Delone sets of finite local complexity and with uniform patch frequencies it is well known that the patch counting entropy computed along the closed centred balls is zero. We consider such sets in the setting of sigma-compact locally compact Abelian groups and show that the topological entropy of the associated Delone dynamical system is zero. We furthermore construct counterexamples, which show that the patch counting entropy of such sets can be non-zero in this context. Other counterexamples will show that the patch counting entropy of such a set can not be computed along a limit and even be infinite in this setting.

Presentation 4.106. **Time and Place:** Friday 12:00, HS14, see 2.6.
Speaker: Olena Karpel
Title: Generalized Bratteli-Vershik diagrams
Abstract: Bratteli diagrams are a powerful tool for the study of dynamical systems in measurable, Cantor and Borel dynamics. The set of invariant measures, minimal components, structure of the orbits of the transformation become more transparent when one deals with the corresponding Bratteli-Vershik dynamical systems. We will consider various classes of generalized Bratteli diagrams which appear in Borel dynamics, discuss the properties of their tail equivalence relations and the corresponding Vershik maps, the sets of invariant finite and infinite σ-finite measures, and connections with random walks. The talk is based on a joint work in progress with Sergey Bezuglyi, Palle E. T. Jorgensen and Shrey Sanadhya.

Presentation 4.107. **Time and Place:** Monday 16:00, HS16, see 2.6.
Speaker: Kristijan Kilassa Kvaternik
Title: The Zero Entropy Locus for the Lozi Maps
Abstract: The Lozi map family is a 2-parameter family of piecewise affine homeomorphisms of the Euclidean plane given by

$$L_{a,b} \colon \mathbb{R}^2 \to \mathbb{R}^2,\ L_{a,b}(x, y) = (1 + y - a|x|, bx),$$

where $a, b \in \mathbb{R}$. In this talk we will present an expansion of the known results about the topological entropy of the Lozi map, $h_{top}(L_{a,b})$, by proving that $h_{top}(L_{a,b}) = 0$ in a specific region in the parameter space for which the period-two orbit is attracting and there are no homoclinic points for the fixed point X in the first quadrant. This is joint work with Michal Misiurewicz (IUPUI, Indianapolis) and Sonja Štimac (University of Zagreb).

Presentation 4.108. **Time and Place:** Friday 11:00, HS14, see 2.6.
Speaker: Przemysław Kucharski
Title: Orientation preserving Lozi mappings
Abstract: The family of Lozi mappings is a parametrized family of piecewise affine planar homeomorphisms given by $f_{(a,b)}(x, y) = (1+y-a|x|, bx)$ for $a, b \in \mathbb{R}$. It has been introduced in 1978 by R. Lozi as a simplification of Hénon family, potentially sharing some of its properties and being more approachable. In 1980 M. Misiurewicz proved that for a certain subset of parameter space for which $f_{(a,b)}$ is orientation reversing, that is for $b > 0$, there exists an attractor for $f_{(a,b)}$ on which $f_{(a,b)}$ is mixing. Since then Lozi family has been studied in terms of its entropy, possible coding, characterisation as inverse limits of certain spaces, either as an example of existing phenomena, or as a stepping stone towards more general families. Yet it has not been rigorously verified that attractors of Lozi family exist for $b < 0$, that is in the orientation preserving case. We will talk about this result and its consequences.

Presentation 4.109. **Time and Place:** Tuesday 10:30, HS13 (online), see 2.6.
Speaker: Dominik Kwietniak
Title: Borel complexities of sets of generic points
Abstract: I will survey what we know, and what we do not know about possible Borel complexities of sets of generic points in topological dynamical systems.

Presentation 4.110. **Time and Place:** Tuesday 11:30, HS13, see 2.6.
Speaker: Michael Megrelishvili
Title: Topological group actions by group automorphisms and Banach representations
Abstract: Topological group actions by group automorphisms and Banach representations tex: This project is dedicated to Vladimir Pestov on the occasion of his 65th birthday. To every Banach space V one may associate a continuous dual action of the topological group $Iso(V)$ of all linear isometries on the weak-star compact unit ball B^* of the dual space V^*. Which actions $G \times X \to X$ are "subactions" of $Iso(V) \times B^* \to B^*$ for nice Banach spaces V ? We study Banach representability for actions of topological groups on groups by automorphisms; in particular, actions on itself by conjugations. The natural question is to examine when we can find representations on low complexity Banach spaces. In contrast to the standard left action of a locally compact second countable group G on itself, the conjugation action need not be reflexively representable even for $SL_2(R)$. The conjugation action of $SL_n(R)$ is not Asplund representable for every $n > 3$. The linear action of $GL_n(R)$ on R^n, for every $n > 1$, is not representable on Asplund Banach spaces. On the other hand, this action is representable on a Rosenthal Banach space (not containing an isomorphic copy of l_1). The conjugation action of a locally compact group need not be Rosenthal representable (even for Lie groups). This is unclear for $SL_2(R)$. As a byproduct we obtain some counterexamples about Banach representations of homogeneous G-actions G/H. For more details we refer to arXiv:2110.01386, 2021.

Presentation 4.111. **Time and Place:** Thursday 16:00, HS16, see 2.6.
Speaker: Olivier Olela Otafudu
Title: On entropies in quasi-metric spaces
Abstract: Quasi-uniform entropy $hQU(\psi)$ is defined for a uniformly continuous self-map ψ on a quasi-metric space (X, q). General statements are proved about this entropy, and it is shown that the quasi-uniform entropy $hQU(\psi, q)$ is less or equals to the uniform entropy $hU(\psi, qs)$ for a uniformly continuous self-map ψon a quasi-metric space (X, q). Finally we proved that the completion theorem for quasi-uniform entropy holds in the class of all join-compact quasi-metric spaces.

Presentation 4.112. **Time and Place:** Monday 17:00, HS16, see 2.6.
Speaker: Dyi-Shing Ou
Title: Transitions in dynamical systems from one- to two-dimensions
Abstract: Studies show that the possible dynamical behavior of a system is constrained by the dimension of its phase space. Here, we investigate how the constraint is lifted as the dimension increases. In particular, we view the Hénon [H] and the Lozi [L] families as perturbations of the unimodal and the tent families in two dimensions. We introduce a renormalization model and use the model to explain the following phenomena:

1. The Hénon attractor does not depend on the parameters continuously. In fact, the prime end rotation number [KP] of the attractor is discontinuous. (with J. Boroński)

2. On continuous interval mappings, all possible trajectories can be classified by a forcing relation [G, CE] based on the kneading theory. However, the forcing relation does not have a continuation in the Hénon and the Lozi families, even when the families are arbitrary close to one dimension [Ou].

3. A two-dimensional system can have infinitely many periodic attractors [N1, N2, R], whereas a sufficiently smooth one-dimensional system can not [S].

4. There are no Fibonacci maps [LM] in two dimensions.

References

[H] Hénon, A two-dimensional mapping with a strange attractor, Commun. Math. Phys. 50 (1976) 69–77.

[L] Lozi, Un attracteur étrange (?) du type attracteur de Hénon, Le Journal De Physique Colloques. 39 (1978) C5–9.

[KP] Koropecki and Passeggi, A Poincaré–Bendixson theorem for translation lines and applications to prime ends, Commentarii Mathematici Helvetici. 94 (2019) 141–183.

[G] Guckenheimer, Sensitive dependence to initial conditions for one dimensional maps, Commun. Math. Phys. 70 (1979) 133–160.

[CE] Collet and Eckmann, Iterated maps on the interval as dynamical systems, Birkhäuser (1980).

[Ou] Critical points in higher dimensions, I: Reverse order of periodic orbit creations in the Lozi family, arXiv:2203.02326 (2022).

[N1] Newhouse, Diffeomorphisms with infinitely many sinks, Topology. 13 (1974) 9–18.

[N2] Newhouse, The abundance of wild hyperbolic sets and non-smooth stable sets for diffeomorphisms, Publications Mathématiques De l'IHÉS. 50 (1979) 101–151.

[R] Robinson, Bifurcation to infinitely many sinks, Commun. Math. Phys. 90 (1983) 433–459.

[S] Singer, Stable orbits and bifurcation of maps of the interval, SIAM Journal on Applied Mathematics. 35 (1978) 260–267.

[LM] Lyubich and Milnor, The Fibonacci unimodal map, Journal of the American Mathematical Society. 6 (1993) 425–457.

Presentation 4.113. **Time and Place:** Tuesday 12:00, HS13, see 2.6.
Speaker: Habibeh Pourmand
Title: The mean orbital pseudo-metric in topological dynamics
Abstract: We study properties and applications of the mean orbital pseudo-metric $\bar{\rho}$ on a topological dynamical system (X, T) defined by

$$\bar{\rho}(x, y) = \limsup_{n\to\infty} \min_{\sigma\in S_n} \frac{1}{n} \sum_{k=0}^{n-1} d(T^k(x), T^{\sigma(k)}(y)),$$

where $x, y \in X$, d is a metric for X, and S_n is the permutation group of the set $\{0, 1, \ldots, n-1\}$. Writing $\hat{\omega}(x)$ for the set of T-invariant measure generated by the orbit of a point $x \in X$, we prove that the function $x \mapsto \hat{\omega}(x)$ is $\bar{\rho}$ uniformly continuous. This allows us to characterise equicontinuity with respect to the mean orbital pseudo-metric ($\bar{\rho}$-equicontinuity) and connect it to such notions as uniform or continuously pointwise ergodic systems studied recently by Downarowicz and Weiss. This is joint work with F. Cai, D. Kwietniak, and J. Li.

Presentation 4.114. **Time and Place:** Friday 10:30, HS14, see 2.6.
Speaker: Peter Raith
Title: Stability of the topological pressure for continuous piecewise monotonic interval maps
Abstract: Suppose that $T : [0, 1] \to [0, 1]$ is a piecewise monotonic map. This means there exists a finite partition Z of $[0, 1]$ into pairwise disjoint open intervals whose union of their closures equals $[0, 1]$ such that $T|_Z$ is continuous and strictly monotonic for every $z \in Z$ Also continuously differentiable piecewise monotonic maps will be considered. For these classes of transformations two topologies will be considered. One of them is the C^0-topology but requiring that the maps have the same number of intervals of monotonicity. The second one is the C^1-topology allowing different numbers of intervals of monotonicity but the number of intervals of monotonicity bounded by a given number N. Continuity of the topological pressure will be investigated. If $p(T, f) \geq \sup_{x\in[0,1]} f(x)$

then the topological pressure is lower semi-continuous (in both topologies). Regarding the C^1-topology one has always upper semi-continuity of the topological pressure. For the C^0-topology this is not the case in general. Upper bounds of the "jumps up" are given. The topological pressure is upper semi-continuous for all weight functions if and only if there are no periodic points among the endpoints of intervals of monotonicity (here 0 and 1 are not considered as endpoints).

Presentation 4.115. **Time and Place:** Monday 16:30, HS16, see 2.6.
Speaker: Sonja Štimac
Title: Classification of the Lozi maps
Abstract: In this talk, I will show how we classified the Lozi maps (up to conjugacy, for Misiurewicz's set of parameters) by using two powerful tools, the symbolic dynamics, and the inverse limit spaces. This is joint work with Jan Boronski.

Presentation 4.116. **Time and Place:** Thursday 17:00, HS16 (online), see 2.6.
Speaker: Chenxi Wu
Title: Entropy and kneading of interval and tree maps
Abstract: This is a joint work with Giulio Tiozzo (U Toronto), Kathryn Lindsey (Boston College) and Ethan Farber (Boston College). We developed kneading theories for certain families of interval maps as well as maps on finite simplicial trees, and used them to study the geometry of the Galois conjugates of the exponents of their topological entropies and established the connection between these Galois conjugates and iterative function systems. As applications these gives necessary conditions for a number to be a core entropy of a superattracting map.

I will cover ideas in:

H. Bray, D. Davis, K. Lindsey and C. Wu. The shape of Thurston's Master Teapot, Advances in Mathematics 377, 2021. doi:10.1016/j.aim.2020.107481.

arXiv:2112.14590

and an upcoming paper.

4.8 Tiling Spaces

Presentation 4.117. **Time and Place:** Wednesday 9:00, HS13, see 1.
Speaker: Lorenzo Sadun
Title: Classifying homeomorphism of tiling spaces
Abstract: A basic goal of algebraic topology is to classify maps between spaces up to homotopy, isotopy, or other equivalence. We show that homeomorphisms $h : \Omega \to \Omega'$ of spaces of tilings with "finite local complexity" are classified, up to homotopy and local relabeling, by the first Čech cohomology $\check{H}^1(\Omega, \mathbb{R}^d)$ of Ω with values in $\mathbb{R}^d$. This implies that all homeomorphisms of FLC tiling spaces can be decomposed as the composition of three pieces: • A map from the source space Ω to itself that is homotopic to the identity map. • A shape change, in which the shapes and sizes of the tiles are altered but the combinatorics of the tilings is preserved. • A local relabeling (e.g. breaking each "A" tile into three smaller pieces). This is joint work with Antoine Julien.

Presentation 4.118. **Time and Place:** Wednesday 10:30, HS13, see 2.7.
Speaker: Nicolas Bedaride

Title: Cohomology of cut and project tiling"
Abstract: We consider tilings of the plane with 12-fold symmetry obtained by the cut and projection method. To do this we completely describe the window, the orbits of lines under the group action and the orbits of 0-singularities. The complete family of generalized 12-fold tilings can be described using 2-parameters and it presents a surprisingly rich cohomological structure. To put this finding into perspective, one should compare our results with the cohomology of the generalized 5-fold tilings (more commonly known as generalized Penrose tilings). In this case the tilings form a 1-parameter family, which fits in simply one of two types of cohomology.

Presentation 4.119. **Time and Place:** Tuesday 16:00, HS11 (online), see 2.7.
Speaker: Akshat Das
Title: Bounded remainder sets for rotations on compact groups Bounded remainder sets for a dynamical system are sets for which the Birkhoff averages of return times differ from the expected values by at most a constant amount. These sets are rare and important objects which have been studied, especially in the context of Diophantine approximation, for over 100 years. In the last few years, there have been a number of results which have culminated in explicit constructions of bounded remainder sets for toral rotations in any dimension, of all possible allowable volumes. In this talk, we are going to give a survey of these results, the recent constructions of bounded remainder sets for rotations on the adelic torus by Alan Haynes, Joanna Furno and Henna Koivusalo and finally give a brief description of a simple, explicit construction of polytopal bounded remainder sets of all possible volumes, for any irrational rotation on the d dimensional adelic torus $\mathbb{A}^d/\mathbb{Q}^d$. Our construction involves ideas from dynamical systems and harmonic analysis on the adeles, as well as a geometric argument that reduces the existence argument to the case of an irrational rotation on the torus $\mathbb{R}^d/\mathbb{Q}^d$. This is joint work with Joanna Furno and Alan Haynes.

Presentation 4.120. **Time and Place:** Wednesday 11:30, HS13, see 2.7.
Speaker: Christopher Cabezas
Title: Homomorphisms between multidimensional substitutive subshifts
Abstract: Homomorphisms are topological factors between topological dynamical systems, up to $GL(d,\mathbb{Z})$-transformations. This notion extends the classical dynamical ones like factor, conjugacies and automorphisms. While the automorphism group is the centralizer of the action group in the group of self-homeomorphisms in the phase space, the isomorphism group (invertible homomorphisms) is the normalizer of the action group. In this talk we will present some recent results about some rigidity properties of homomorphisms between substitutive subshifts generated by constant-shape substitutions. Constant-shape substitutions are a multidimensional generalization of constant-length substitutions, where any letter is assigned a pattern with the same shape.

Presentation 4.121. **Time and Place:** Tuesday 14:30, HS11, see 2.7.
Speaker: María-Isabel Cortez
Title: Toeplitz subshifts and invariant measures
Abstract: In this talk we recall the concept of a Toeplitz subshift, given for the action of any residually finite group. We will show some properties and results involving these subshifts which could be useful to understand the behaviour of dynamical systems given for the action of groups beyond $\mathbb{Z}$.

Presentation 4.122. **Time and Place:** Tuesday 11:30, HS11, see 2.7.
Speaker: Dirk Frettlöh
Title: Substitution tilings with transcendental inflation factor"
Abstract: Tiling spaces are topological spaces whose elements are aperiodic biinfinite words (consisting of letters) or aperiodic tilings (consisting of tiles, hence in 1D: intervals of different lengths). Usually there are only finitely many types of letters, respectively tiles. Quite often the words or tilings are constructed via a substituion rule (i.e., inflate, subdivide). In this case the inflation factor is always an algebraic number. Only recently tilings with infinitely many tile types were studied in more detail w.r.t. their topological and dynamical properties. The question arose whether there are substitution rules with transcendental inflation factor (and then necessarily infinitely many letters resp. tile types). This talk explains concepts and background and gives an affirmative answer. This is joint work with Alexey Garber (UT Rio Grande Valley) and Neil Mañibo (OU Milton Keynes)

Presentation 4.123. **Time and Place:** Tuesday 16:30, HS11, see 2.7.
Speaker: Thomas Fernique
Title: Local rules for Cut and Project Tilings
Abstract: The cut-and-project method is a classical method to define quasi-periodic tilings, which are often used to model quasicrystals. Penrose or Ammann-Beenker tilings are well known examples. A possible stabilization of quasicrystals in terms of short-range energetic interactions leads to the question of which tilings are characterized by their local patterns only. This is for instance the case for Penrose tilings, but not for Ammann-Beenker tilings. We propose an overview of the main results known to date.

Presentation 4.124. **Time and Place:** Wednesday 11:00, HS13, see 2.7.
Speaker: Franz Gähler
Title: The (profinite) fundamental group of a tiling space
Abstract: Quite generally, tiling spaces can be regarded as inverse limits of CW-complexes. As a result, these spaces are not path-connected, so that topological invariants which see only the path components will miss essential information. This is the case for homotopy groups, and the fundamental group in particular. Also, since the fundamental group is not well-behaved when taking inverse limits, it cannot be computed from the fundamental groups of the approximant complexes, as it can be done for Čech cohomology. Here, we construct a profinite version of the fundamental groups of the approximant complexes of a tiling space, and show that their inverse limit is not only well defined, but provides a genuine invariant for the inverse limit space. While such a profinite fundamental group $\hat{\pi}_1$ is still a complicated object to study, we show that certain fingerprints of it are practically computable. This is so in particular for the size of the sets $Hom(\hat{\pi}_1, G)$, with G any finite group. It turns out that such fingerprints are a powerful tool to distinguish substitution tiling spaces, especially in one dimension. This is illustrated with many examples.

Presentation 4.125. **Time and Place:** Tuesday 12:00, HS11, see 2.7.
Speaker: Alexey Garber
Title: Counting tiles in substitution tilings
Abstract: For classical substitution tilings on finite sets of prototiles, the order of growth of the number of tiles in a large supertile is governed by the Perron-Frobenius eigenvalue. The order of

the second term in the counting function can be either exponential or polynomial times exponential where the exponent comes from the second largest eigenvalue of the substitution matrix. In this talk we will discuss that for substitutions on infinite sets of prototiles the second term may behave differently. Particularly, we will show that it may behave as the sequence of Catalan numbers or as ratio of exponent and half-integer power for a certain family of substitutions. The talk is based on a joint work with Dirk Frettlöh (Bielefeld University) and Neil Mañibo (Open University, UK).

Presentation 4.126. **Time and Place:** Tuesday 10:30, HS11 (online), see 2.7.
Speaker: Tobias Hartnick
Title: Transverse measures in the theory of tiling spaces
Abstract: We explain how Connes' theory of transverse measures can be used in the study of tiling spaces, both in Euclidean and non-Euclidean geometries. We will explain the general formalism and relate it to a number of classical subjects such as pattern equivariant functions, patch frequencies, densities of sphere packings and harmonic functions on pattern trees. In the cut-and-project case we explain how patch frequencies can be related to Haar measures of acceptance domains in the sense of Koivusalo-Walton through the theory of transverse measures. In the case of self-similar tilings we relate transverse measures to substitution matrices. In both cases, we provide new explicit computations of patch frequencies. Based on joint work with Michael Björklund, Yakov Karasik, Daniel Roca Gonzalez and Maximilian Wackenhuth.

Presentation 4.127. **Time and Place:** Tuesday 15:00, HS11, see 2.7.
Speaker: Maryam Hosseini
Title: Topological Factoring Between Two Cantor Systems
Abstract: In this talk I will talk about the topological factoring between two minimal systems on the Cantor set. In this direction, topological and algebraic rank of Cantor systems are considered. The Bratteli-Vershik representation of Cantor minimal systems makes some "visual" tools for describing the factoring process. By time permission, I may talk about generalization to the non-minimal case.

Presentation 4.128. **Time and Place:** Thursday 11:00, HS11, see 2.7.
Speaker: Hyeeun Jang
Title: Directional expansiveness of Penrose tilings
Abstract: We extend a well known theorem Keynes-Robertson (1969) that a homeomorphism of a compact metric space is a factor of a subshift to $\mathbb{Z}^d$ version, which is used for tensor product (product type) action and tiling flows. This development forms a new theorem that tensor product action of two subshifts has just vertical and horizontal non-expansive directions. On this basis, our main result of the thesis shows that the Penrose tiling dynamical system has exactly five non-strongly expansive directions. The proof involves using Wang tiles to show that Penrose tilings are essentially tensor products of two Sturmian dynamical systems.

Presentation 4.129. **Time and Place:** Tuesday 9:00, HS11, see 2.7.
Speaker: Johannes Kellendonk
Title: Ellis semigroup for constant length substitutions
Abstract: The Ellis semigroup (or enveloping semigroup) of a topological dynamical system is a compactification of the group action in the topology of pointwise convergence. Its algebraic

and topological properties characterise the dynamical system. It hence characterises tilings via their dynamical systems. We give an overview on recent results obtained in the analysis of this semigroup for constant length substitutions.

Presentation 4.130. **Time and Place:** Tuesday 17:00, HS11, see 2.7.
Speaker: Jeong-Yup Lee
Title: Understanding substitution tilings with pure discrete spectrum through a cut-and-project method
Abstract: After the discovery of quasicrystal structures, there has been a lot of study on pure discrete spectrum of tiling dynamics as a characterizing property. There is a general theory that a regular model set, which is a cut and project set of a higher dimension lattice, has pure discrete spectrum [Schlottmann 2000]. But the converse is not true in general. We restrict tilings to substitution tilings and study the relation between pure discrete spectrum and regular model sets. Under certain assumptions on expansion maps of substitutions and 'unimodularity', the equivalence between the two notions has been shown [Lee-Akiyama-Lee, 2020]. In this talk, we eliminate the unimodularity condition in the earlier result and get the same equivalence.

Presentation 4.131. **Time and Place:** Tuesday 9:30, HS11, see 2.7.
Speaker: Jianlong Liu
Title: K-theory of two-dimensional substitution tiling spaces from AF-algebras"
Abstract: A tiling space carries an action by translations, giving a groupoid C^*-algebra. If the tiling arises from a substitution rule, one obtains an AF-algebra for each intermediate dimension. For $d = 1$, Putnam (1989) proved that these AF-algebras are sufficient in constructing the K-theory of the groupoid C^*-algebra. For $d = 2$, Julien-Savinien (2016) showed a proof-of-concept for the chair tiling. Using the six-term exact sequence in relative K-theory introduced by Haslehurst (2021), we give a simple proof for d=1,2 that the K-theory of this groupoid C^*-algebra can always be constructed from that of the attached AF-algebras, and, incidentally, relate everything back to cohomology.

Presentation 4.132. **Time and Place:** Tuesday 11:00, HS11 , see 2.7.
Speaker: Dan Rust
Title: Substitutions on compact alphabets
Abstract: One dimensional substitutions and their tiling spaces are classical objects in tiling theory representing some of the most well-studied and 'simple' aperiodic systems. Classically they are defined on finite alphabets, but it has recently become clear that a systematic study of substitutions on infinite alphabets is needed. I'll introduce natural generalisations (for compact Hausdorff alphabets) of classical concepts like legal words, repetitivity, primitivity, etc., and report on new progress in an attempt to characterise unique ergodicity of these systems, where surprisingly, primitivity is not sufficient. As Perron-Frobenius theory fails in infinite dimensions, more sophisticated technology from the theory of positive operators is employed. There are still lots of open questions, and so a ground-level introduction to these systems will hopefully be approachable and stimulating. This is joint work with Neil Mañibo and Jamie Walton.

Presentation 4.133. **Time and Place:** Thursday 12:00, HS11, see 2.7.
Speaker: Lorenzo Sadun

Title: Mass transport on aperiodic tilings
Abstract: Suppose that we have two mass distributions on a d-dimensional aperiodic tiling, each defined by a local rule such as "put 3 kg on every A tile and 1 kg on every B tile" or "put 5kg on every A tile that is next to a B tile". When is it possible to do a bounded transport from one distribution to the other? When is it possible to do that transport according to a local rule? When is it possible to do that transport in a way that is arbitrarily well approximated by a local rule? All of these questions boil down to questions about the top Čech cohomology of the continuous hull of our tiling. We answer those questions for a wide class of substitution tilings. This is joint work with Michael Kelly.

Presentation 4.134. **Time and Place:** Wednesday 12:00, HS13, see 2.7.
Speaker: Shrey Sanadhya
Title: Universality for $\mathbb{R}^d$-flows.
Abstract: A dynamical system is called universal if any system with lower entropy can be embedded into it. In this talk, we will discuss universality for $\mathbb{R}^d$ flows ($d > 1$) both in ergodic and Borel contexts. We will discuss a specification property that implies universality for $\mathbb{R}^d$ flows and provide an example of a tiling dynamical system with this specification property. This is joint work with Tom Meyerovitch.

Presentation 4.135. **Time and Place:** Thursday 11:30, HS11, see 2.7.
Speaker: Yaar Solomon
Title: A dichotomy for bounded displacement equivalence
Abstract: Delone sets Y and Z are BD-equivalent if there exists a bounded displacement (BD) mapping between them, namely a bijection $f : Y \to Z$ such that the quantity $\|f(y) - y\|(y \in Y)$ is bounded. We study the cardinality of the set of equivalence classes and show that a minimal space of Delone sets either contains a set which is BD to a lattice, in which cases all points in the space are such, or there are continuously many BD-classes represented in the space. If time permits, we will discuss some applications of this dichotomy to several known constructions from the theory of aperiodic order. Based on a joint work with Yotam Smilansky.

Presentation 4.136. **Time and Place:** Thursday 10:30, HS11, see 2.7.
Speaker: Mike Whittaker
Title: Self-similarity of substitution tiling semigroups
Abstract: In this talk I'll introduce substitution tilings and an associated semigroup defined by Kellendonk. I'll show that this semigroup defines a self-similar action on a topological Markov shift that's conjugate to the punctured tiling space. The limit space of the self-similar action turns out to be the Anderson-Putnam complex of the substitution tiling and the inverse limit recovers the translational hull. This was joint work with Jamie Walton.

5 Places to eat and drink

Cafés and coffeeplaces

- Close to the mathematics department:
  - Coffee Break, Berggasse 37, 1090 Wien
  - Caffé a Casa, Servitengasse 4A, 1090 Wien
  - Café Konditorei Bürger, Servitengasse 12, 1090 Wien
  - La Mercerie, Berggasse 25, 1090 Wien
  - Café— Naschsalon, Liechtensteinstraße 38A, 1090 Wien
  - Hofkellerei im Gartenpalais, Fürstengasse 1, 1090 Wien
  - Goppion Caffé Vienna, Liechtensteinstraße 46a, 1090 Wien
  - Café Stein, Währinger Straße 6-8, 1090 Wien
  - Café Le Marché, Währinger Straße 6-8, 1090 Wien
  - Weltcafé, SchwarzspanierstraÃŸe 15, 1090 Wien
  - Café Freud, Berggasse 17, 1090 Wien
  - Luxor, Grünentorgasse 19B, 1090 Wien
  - Café Telegraph, Garnisongasse 7, 1090 Wien
  - Café Votiv, Reichsratsstraße 17, 1010 Wien
- Classic(-like) Viennese Coffee Houses:
  - Café Central, Herrengasse 14, 1010 Wien
  - Café Landtmann, Universitätsring 4, 1010 Wien
  - Café Museum, Operngasse 7, 1010 Wien
  - Café Schwarzenberg, Kärntner Ring 17, 1010 Wien
  - Café Sacher Wien, Philharmoniker Straße 4, 1010 Wien
  - K. u. K. Hofzuckerbäckerei Demel, Kohlmarkt 14, 1010 Wien
  - Teehaus Haas & Haas, Stephansplatz 4, 1010 Wien
  - Café Präckel, Stubenring 24, 1010 Wien
  - Café Ritter Ottakring, Ottakringer Str. 117, 1160 Wien
  - Café Eiles, Josefstädter Staße. 2, 1080 Wien
  - Café Tirolerhof, Führichgasse 8, 1010 Wien
  - Café Goldegg, Argentinierstraße 49, 1040 Wien

  - Café Sperl, Gumpendorfer Straße 11, 1060 Wien

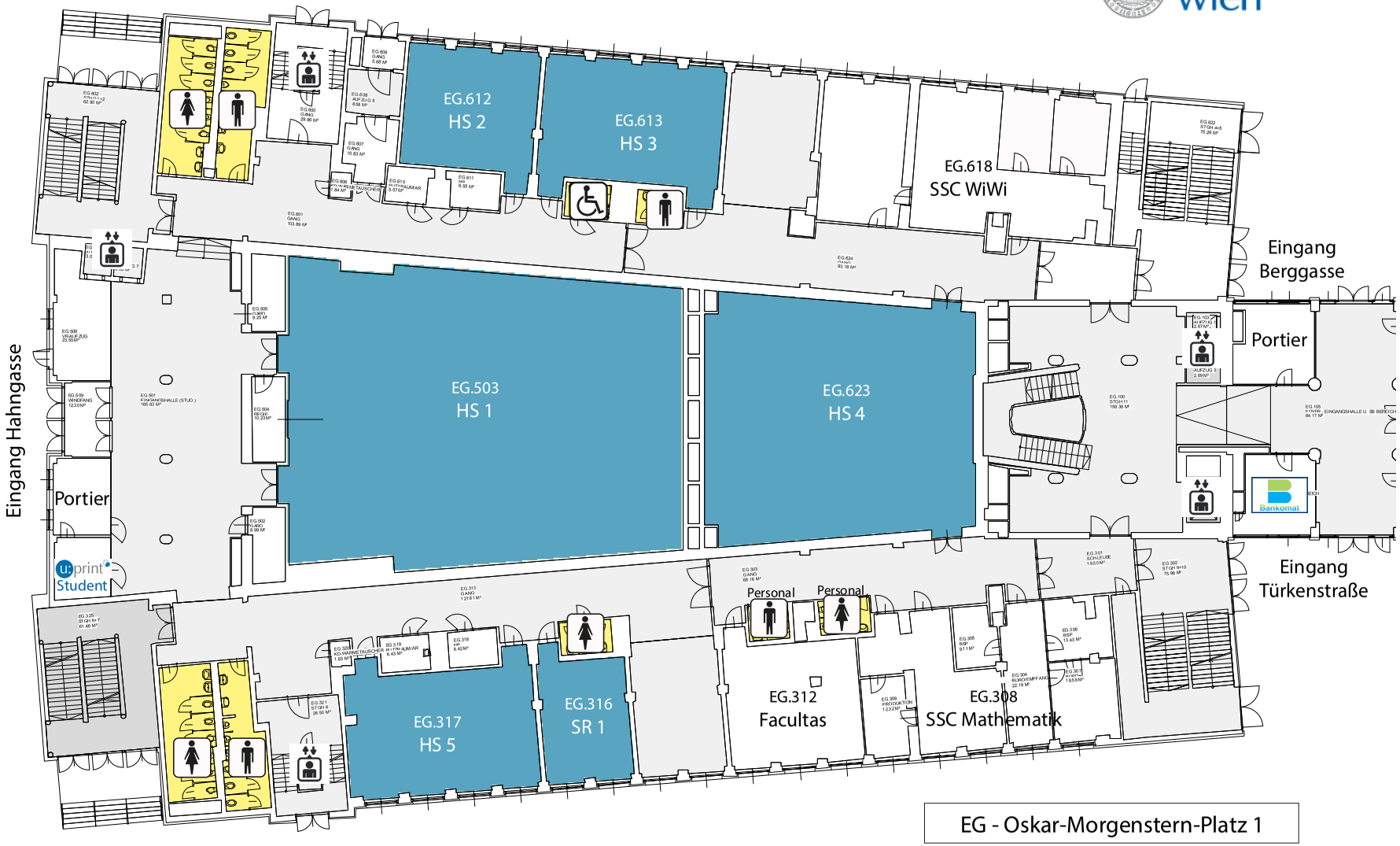
- Alternatives (special location, special experience, very good coffee):
  - Café Korb, Brandstätte 7/9, 1010 Wien
  - CoffeePirates, Spitalgasse 17, 1090 Wien
  - Café Weidinger, Lerchenfelder Gürtel 1, 1160 Wien
  - Schlosscafé im Oberen Belvedere, Prinz Eugen-Straße 27, 1030 Wien
  - Dorotheum Café, Spiegelgasse 16, 1010 Wien
  - TOP Kino, Rahlgasse 1, 1060 Wien
  - phil, Gumpendorfer Straße 10 - 12, 1060 Wien
  - Vollpension, Schleifmühlgasse 16, 1040 Wien
  - Café Kafka, Capistrangasse 8, 1060 Wien
  - Brasserie Palmenhaus, Burggarten 1, 1010 Wien

- Traditional chains (multiple locations in Vienna):
  - Café-Konditorei Aida
  - Café Diglas
  - Kurkonditorei Oberlaa
  - K.u.K. Hofzuckerbäcker L. Heiner

Restaurants near the Department

1. Hitomi (Japanese)
2. Küche 18 (Chinese)
3. Goldenener Drache (Chinese)
4. Der Wiener Deewan (Pakistani Student Buffet)
5. Rice Time (Vietnamese)
6. Oasia (Japanese)
7. Riva (Italian)
8. Scala (Italian)
9. Vecchi Amici (Italian)
10. Candis (Italian)
11. Rembetiko (Greek)
12. Rebhuhn (Austrian)
13. Porzellan (Austrian)
14. Gasthaus Wickerl (Austrian)
15. Zum roten Bären (Austrian)
16. Servitenwirt (Austrian)
17. Landsknecht (Austrian)
18. Plan Quadrat (Austrian)
19. Suppenwirtshaft (Whatever)
20. Weltcafé (Whatever)
21. Pacado (Whatever)
22. Anker (Bakery)
23. Ströck (Bakery)
24. Café a Casa (Café)
25. Telegraph (Café)
26. Das 1090 (Café + Gastropub)
27. The Beaver Brewery (Café + Gastropub)
28. Die Fladerei (Fladen/Flammkuchen $\approx$ focaccio)
29. Kantine Thai
30. Altes AKH (Gangl, Ambulanz, Solo Pizza e Birra 3 x Austrian)
31. Summerstage (Various Bars/Gastropubs in the open)
32. Sentepe (Lebanese)


Erwin Schrödeer Institut
ESI
27
↑200 m
Liechtenstein Palace & Park
Subway Roßauerlände
Medical Museum Narrenturm
Math
Logic
Danube Canal
Subway Schotten-ring
T = trams 37, 38, 40, 41, 42
D = D-tram
Google
Map data ©2017 Google
Austria
50 m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EG.612
HS 2
EG.613
HS 3
EG.618
SSC WiWi
Eingang Berggasse
Portier
EG.503
HS 1
EG.623
HS 4
Eingang Hahngasse
Portier
Bankomat
Eingang Türkenstraße
u:print Student
Personal
Personal
EG.317
HS 5
EG.316
SR 1
EG.312
Facultas
EG.308
SSC Mathematik
EG - Oskar-Morgenstern-Platz 1

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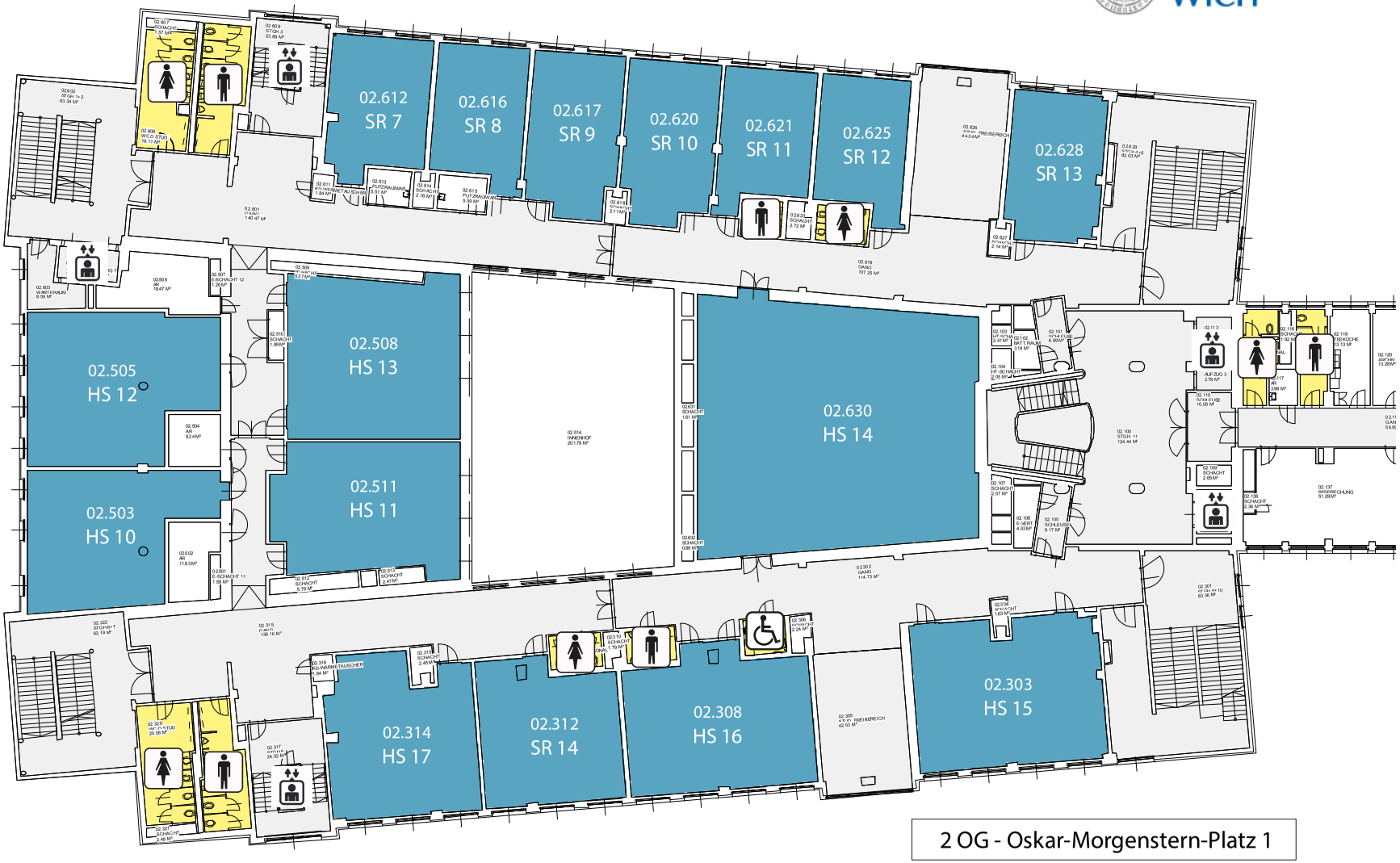

2 OG - Oskar-Morgenstern-Platz 1