Discrete Math Days 2022 (DMD 20/22)
Santander, 4–6 July 2022

DMD 2022

Programme

Monday, July 4

Time	Aula 1	Aula 2
8:15-8:50	Registration (Aula 6)	
9:00-9:25	Opening (Aula Magna)	
9:30-10:30	**Pascal Schweitzer (Aula Magna)** *Chair:* Marc Noy *Symmetry in discrete structures: graphs, groups and algorithms*	
10:30-11:15	Coffee break	

Time	Aula 1 — *Chair:* Juanjo Rué	Aula 2 — *Chair:* Arnau Padrol
11:15-11:35	Aida Abiad, Boris Brimkov, Sakander Hayat, **Antonina P. Khramova** and Jack H. Koolen *Extending a conjecture of Graham and Lovász on the distance characteristic polynomial*	**Giulia Codenotti**, Thomas Hall and Johannes Hofscheier *Generalised flatness constants: a framework applied in dimension 2*
11:35-11:55	José Aliste-Prieto, **Anna De Mier**, Rosa Orellana and José Zamora *Polynomials for marked graphs and the chromatic symmetric function*	**Eduardo Lucas Marín** *On discrete Borell-Brascamp-Lieb type inequalities for big negative parameters*
11:55-12:15	Olaf Parczyk, Sebastian Pokutta, **Christoph Spiegel** and Tibor Szabó *New Ramsey Multiplicity Bounds and Search Heuristics*	Bojan Bašić and **Anna Slivková** *On the Heesch number in $\mathbb{E}^d$*

Time	Aula 1 — *Chair:* Öznur Yasar Diner	Aula 2 — *Chair:* Julian Pfeifle
12:20-12:40	Delia Garijo, Andrew Goodall and **Lluís Vena** *Homomorphisms between graphs embedded in surfaces*	Davide Bolognini, **Antonio Macchia**, Giancarlo Rinaldo and Francesco Strazzanti *Accessible set systems and a conjecture on Cohen-Macaulay binomial edge ideals*
12:40-13:00	**Irene Gil Fernández** and Hong Liu *How to build a pillar: a proof of Thomassen's conjecture*	Giulia Codenotti, **Stephan Gardoll** and Thorsten Theobald *Combinatorics and preservation of conically stable polynomials*
13:00-13:20	Jacob Lahne, **David Orden**, Katherine Phetxumphou and Marino Tejedor-Romero *Linking+SensoGraph: A new graph-based method for sensory analysis*	**Manuel Radons** and Josué Tonelli-Cueto *Generalized Perron roots and solvability of the absolute value equation*

Lunch break (self-arranged)

Time	Aula 1 — *Chair:* Aida Abiad	Aula 2 — *Chair:* Leo Liberti
16:30-16:50	Fábio Botler, Phablo F.S. Moura and **Tássio Naia** *Seymour's second neighborhood conjecture in arbitrary orientations of a random graph*	**Marie-Charlotte Brandenburg**, Christian Haase and Ngoc Mai Tran *Competitive equilibrium always exists for combinatorial auctions with graphical pricing schemes*
16:50-17:10	David Fabian, **Patrick Morris** and Tibor Szabó *Maximum running times for graph bootstrap percolation processes*	Domingo Gómez-Pérez, Ana I. Gómez and **Francisco-Javier Soto** *A Faster Algorithm for the Two Cluster Partitioning Problem*
17:10-17:30	Márton Borbényi, Panna Fekete, Aranka Hrušková and **Ander Lamaison** *Logarithmic convergence of projective planes*	**Antonio Cañete**, Isabel Fernández and Alberto Márquez *Conway's fried potato problem: a (quadratic) algorithm leading to an optimal division for convex polygons*
17:30-17:45	Short break	
17:45-18:45	**Guillem Perarnau (Aula 1)** *Chair:* Anna de Mier *Wandering on random digraphs*	
18:45-20:45	Welcome reception	

Tuesday, July 5

Time	Aula 1	Aula 2
9:30-10:30	**Marthe Bonamy (Aula 1)** _Chair:_ Lluís Vena _One graph to rule them all: forbidden structures and universal graphs_	
10:30-11:15	Group picture + Coffee break	
	Chair: Guillem Perarnau	_Chair:_ Marthe Bonamy
11:15-11:35	**Alexander Allin** and Alberto Espuny Díaz _An analogue of Chvátal's Hamiltonicity theorem for randomly perturbed graphs_	**Leo Liberti**, Benedetto Manca and Pierre-Louis Poirion _Random projections for the distance geometry problem_
11:35-11:55	**Alberto Espuny Díaz** and Joseph Hyde _Powers of Hamilton cycles in graphs perturbed by a random geometric graph_	**José Manuel Jiménez Cobano**, Haydee Jiménez Tafur and José María Ucha-Enríquez _The weighted sum method for multi-objective optimization using Test Sets via Gröbner Bases_
11:55-12:15	Josep Díaz, **Öznur Yasar Diner**, Maria Serna and Oriol Serra _On Vertex Bisection Width of Random d-Regular Graphs_	Deniz Ağaoğlu Çağırıcı and **Onur Çağırıcı** _Unit disk visibility graphs_
12:15-13:15	Poster session	

List of posters

- Aida Abiad, Jozefien D'haeseleer and **Robin Simoens**.
  Cospectral generalized Johnson and Grassmann graphs

- Tanbir Ahmed, **Luis Boza**, María Pastora Revuelta and María Isabel Sanz.
  Advances on the 3-color off-diagonal generalized Schur numbers $S(3; k_1, k_2, k_3)$

- Gabriela Araujo-Pardo, Cristina Dalfó, Miguel Àngel Fiol and **Nacho López**.
  On bipartite biregular Moore graphs

- **Lidija Čomić** and Paola Magillo.
  Computation of 2D Discrete Geometric Moments through Inclusion-Exclusion

- Adriana Dapena, Magdalena Lemańska, **María José Souto-Salorio** and Francisco Vazquez-Araujo.
  Trees having domination number equal to isolation number

- Magda Dettlaff, Abel Cabrera Martínez, **Magdalena Lemańska** and Juan Alberto Rodríguez-Velázquez.
  Restrained differential of a graph

- Antonio González, **Carmen Hernando** and Mercè Mora.
  Distance-equalizer sets of graphs

- Simon B. Hengeveld and **Antonio Mucherino**.
  The discrete side of Distance Geometry: a focus on the 1-dimensional case

- **Nacho López**, Josep Conde and Gabriela Araujo-Pardo.
  On local bipartite Moore graphs

- **László Németh** and László Szalay.
  Sequences related to square and cube zig-zag shapes

Tuesday, July 5 (cont.)

	Chair: Pascal Schweitzer	*Chair:* David Orden
15:00-15:20	Béla Bajnok and **Péter Pál Pach** *On sumsets of nonbases of maximum size*	Jordi Castellví, Marc Noy and **Clément Requilé** *Enumeration of chordal planar graphs and maps*
15:20-15:40	Anuj Dawar and **Danny Vagnozzi** *A parallel between the descriptive complexities of finite groups and Latin square graphs*	**Philippe Nadeau** *Local parking procedures on the integers*
15:40-16:00	Carlos Marijuán and **Miriam Pisonero** *New Results for the Spectra of Weighted Graphs of Order 5*	Gilad Chase, Neta Dafni, Yuval Filmus and **Nathan Lindzey** *Characterizing the Extremal Families in Erdős–Ko–Rado Theorems*
16:00-16:30	Coffee break	
16:30-17:30	Business meeting	
20:30	Social dinner, Hotel Silken Rio	

Wednesday, July 6

Time	Aula 1	Aula 2
	Chair: Oriol Serra	*Chair:* Antonio Macchia
9:30-9:50	**Mario Huicochea** *Rainbow solutions of a linear equation with coefficients in $\mathbb{Z}/p\mathbb{Z}$* - **CANCELLED**	Arnau Padrol, **Eva Philippe** and Francisco Santos *Many regular triangulations and many polytopes*
9:50-10:10	Daniel Král', **Ander Lamaison** and Péter Pál Pach *Common systems of two equations over the binary field*	Arnau Padrol, Vincent Pilaud and **Germain Poullot** *Deformation cones of graphical zonotopes*
10:10-10:30	Juanjo Rué and **Maximilian Wötzel** *Normal limiting distributions for systems of linear equations in random sets*	Bruno Benedetti and **Marta Pavelka** *2-LC triangulated manifolds are exponentially many*
10:30-11:15	Coffee break	
	Chair: Péter Pál Pach	*Chair:* José A. Samper
11:15-11:35	Oriol Serra and **Maximilian Wötzel** *On a nonabelian Kneser theorem*	Michael Joswig, **Dante Luber**, Georg Loho and Jorge Olarte *Generalized Permutahedra and Positive Flag Dressians*
11:35-11:55	**Miquel Ortega** and Sean Prendiville *Extremal Sidon sets are Fourier uniform, with applications to partition regularity*	**Luis Crespo Ruiz** and Francisco Santos *Multitriangulations and tropical Pfaffians*
11:55-12:15	**Manuel A. Espinosa-Garcia**, Amanda Montejano, Edgardo Roldán-Pensado and J. David Suárez *Sidon-Ramsey and B_h-Ramsey numbers*	**Julian Pfeifle** *Fast positive Plücker trees*
12:20-13:20	**János Pach (Aula 1)** *Crossing lemmas for multigraphs?*	*Chair:* Francisco Santos
13:20	Closure	

Invited talks

Marthe Bonamy (Université de Bordeaux)
One graph to rule them all: forbidden structures and universal graphs

Abstract: Consider all planar graphs on n vertices. What is the smallest graph that contains them all as induced subgraphs?

In this talk, we will gently introduce the audience to the notion of so-called universal graphs (graphs containing all graphs of a given family as induced subgraphs), and focus on the case of graph classes defined by forbidden structures. We present positive and negative results both in dense graphs and in sparse graphs. The audience will also have the answer to the question at the beginning of this abstract, recently established in a breakthrough paper of Dujmović, Esperet, Joret, Gavoille, Micek and Morin.

János Pach (EPFL Lausanne and Rényi Institute Budapest)
Crossing lemmas for multigraphs?

Abstract: The celebrated Crossing Lemma of Thurston and Ajtai, Chvátal, Newborn, and Sze-merédi gives an asymptotically tight lower bound on the number of edge crossing in any drawing of a graph G in the plane which has n vertices and $e > 3n - 6$ edges. The lemma has found many applications in topological graph theory, additive number theory, combinatorial geometry, and elsewhere. In order to extend its range of applications, for more than 40 years, there have been many attempts to strengthen this lemma for various special classes of graphs, and to generalize it to multigraphs (where there can be several edges between any pair of vertices). We describe some recent efforts in this direction, and raise several open problems.

Guillem Perarnau (Universitat Politécnica de Catalunya)
Wandering on random digraphs

Abstract: Random walks on random graphs is an active area of research with numerous results in the last 20 years. While the theory is well developed for undirected graphs, the directed case is much less understood. Unfortunately, networks that arise in applications are often directed by nature (e.g. World Wide Web, citation network, ...). In recent years, new techniques have been developed to study the directed setting. In this talk I will survey some of the most prominent results in the area, including the study of the random stationary measure and the mixing properties of the chain. Time permitting, I will cover two topics more in-depth. First, I will show how directed edges dramatically increase the time required to visit every vertex of the graph. Second, I will present a mathematical framework for the so-called *'power-law hypothesis'*, a property relating in-degrees with Pagerank – the webpage ranking at the core of Googles search engine.

The results presented are joint work with Xing Shi Cai, Pietro Caputo and Matteo Quattropani.

Pascal Schweitzer (TU Darmstadt)
Symmetry in discrete structures: graphs, groups and algorithms

Abstract: The concept of symmetry is ubiquitous in the study of discrete combinatorial objects. The ensemble of symmetries of an object G is its automorphism group $\text{Aut}(G)$. It provides us with structural information of the object. The group also captures how its symmetries relate to one another. While symmetries are interesting to study in their own right, symmetries also have direct applications in diverse areas that make use of combinatorial objects.

In the talk, I will describe various facets of research surrounding the structure, detection and application of symmetries.

- Regarding the *structure of symmetry*, I will discuss automorphism groups of graphs in minor-closed graph classes. Examples of such graph classes include the class of trees, planar graphs, graphs of bounded genus (i.e., graphs embeddable into a fixed surface without crossings), and graphs of bounded tree width. While a classic result of Frucht shows that every finite group is the automorphism group of a finite graph, Babai showed that with a fixed graph class that excludes a fixed minor not all groups can be represented as automorphism groups. The talk will discuss general structure theorems for the automorphism group of minor-closed graph classes.

- Regarding *detection of symmetry*, it is well known that the so-called graph isomorphism problem, which asks us to decide whether two given graphs are isomorphic, is universal in the following sense. The computation of the automorphism group of an arbitrary (explicitly given) combinatorial object reduces, in polynomial time, to the graph isomorphism problem. The isomorphism problem in turn reduces to a related problem, the problem of computing a canonical labeling. In some contexts this is referred to as computing a normal form of a given graph. The talk will discuss some recent advances in the research on the theory and implementation of practical graph isomorphism solvers.

- Regarding *application of symmetry*, I will focus on a particular type of application in finite model theory. Specifically, I will touch on the quest for a logic capturing PTIME and discuss how it relates to the graph isomorphism and graph canonization problems.

This talk is in part an overview over various results obtained within the ERC-Project EngageS (`https://www.mathematik.tu-darmstadt.de/EngageS`) and based on joint work with numerous co-authors.

Places for Lunch

Lunches are self-organised and not included in the registration fee. There are a number of cafeterias in the university area offering a full lunch for about 10 euros. Here are some recommended places near the conference venue. Numbers refer to the map below.

- Cafeterias that offer, sandwiches, platos combinados, and/or mens del da: (1) La Toba, (2) Kiss, (3) Boulevard, (4) Santander Antiguo, (5) La Conchita, (6) Isae, (7) Escudero, (8) Bedoya2.

- Eco-friendly take-away: (9) Ecotierruca.

- More formal/elaborate restaurant with a wider variety of dishes: (10) De Morro Fino.

- The university buildings marked on the map (including the Faculty of Sciences) have cafeterias offering sandwiches and small food.
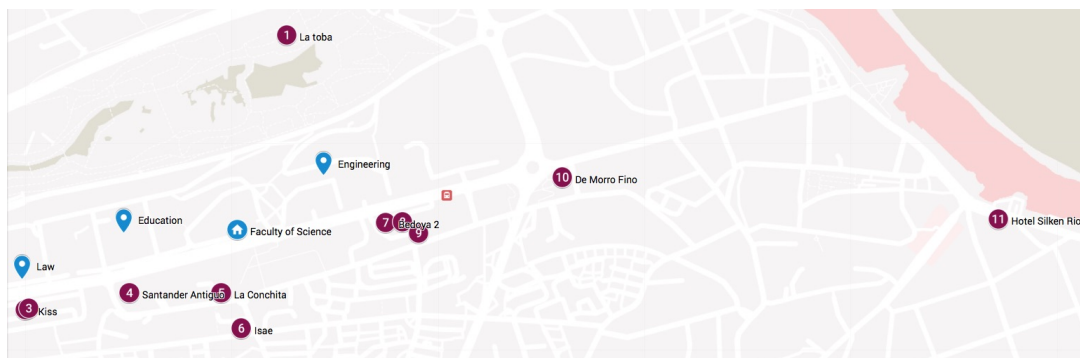
The map also shows the bf Hotel Silken Rio, in El Sardinero, where the social dinner will take place on Tuesday July 5th.