International Workshop on Symmetries of Graph and Networks

关于图与网络对称性的国际研讨会

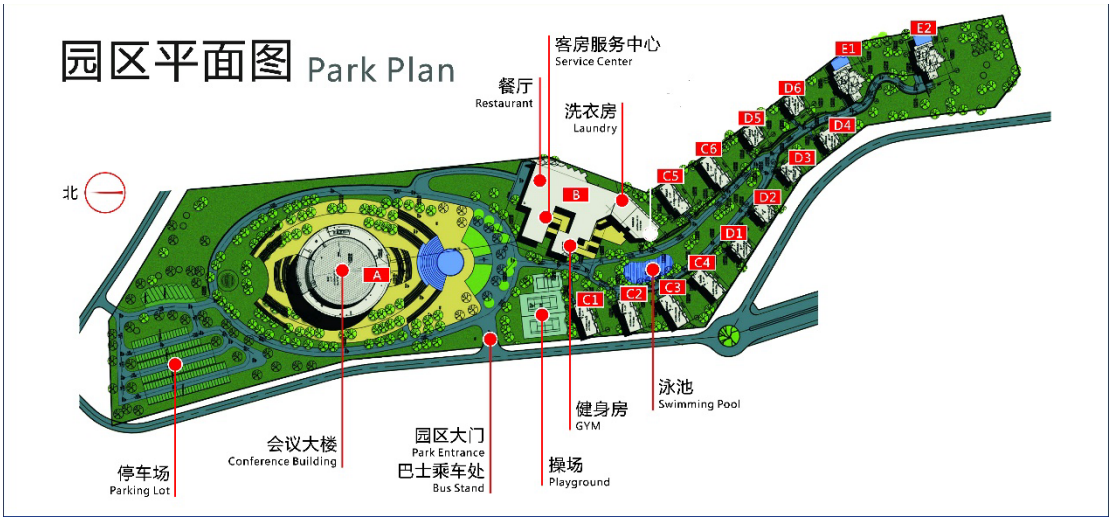
January 29-February 2, 2018

Welcome to TSIMF

The facilities of TSIMF are built on a 23-acre land surrounded by pristine environment at Phoenix Hill of Phoenix Township. The total square footage of all the facilities is over 29,000 square meter that includes state-of-the-art conference facilities (over 10,000 square meter) to hold many international workshops simultaneously, two libraries, a guest house (over 10,000 square meter) and the associated catering facilities, a large swimming pool, gym and sports court and other recreational facilities.

Mathematical Sciences Center (MSC) of Tsinghua University, assisted by TSIMF's International Advisory Committee and Scientific Committee, will take charge of the academic and administrative operation of TSIMF. The mission of TSIMF is to become a base for scientific innovations, and for nurturing of innovative human resource; through the interaction between leading mathematicians and core research groups in pure mathematics, applied mathematics, statistics, theoretical physics, applied physics, theoretical biology and other relating disciplines, TSIMF will provide a platform for exploring new directions, developing new methods, nurturing mathematical talents, and working to raise the level of mathematical research in China.

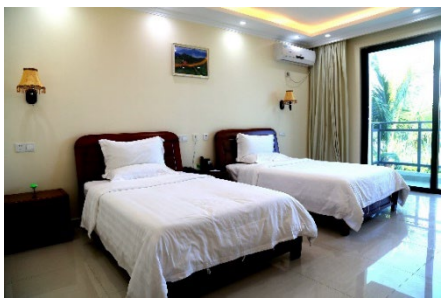
About Facilities



Registration

Conference booklets, room keys and name badges for all participants will be distributed at the Registry. Please take good care of your name badge. It is also your meal card and entrance ticket for all events.

Guest Room



Conference Center can receive about 378 people having both single and double rooms, and 42 family rooms.

All the rooms are equipped with: free Wi-Fi, TV, air conditioning and other utilities

.

Family rooms are also equipped with kitchen and refrigerator.

Library

Opening Hours: 09:00am-22:00pm

TSIMF library is available during the conference and can be accessed by using your room card. There is no need to sign out books but we ask that you kindly return any borrowed books to the book cart in library before your departure.

In order to give readers a better understanding of the contributions made by the Fields Medalists, the library of Tsinghua Sanya International Mathematics Forum (TSIMF) instituted the Special Collection of Fields Medalists as permanent collection of the library to serve the mathematical researchers and readers.
So far, there are 210 books from 43 authors in the Special Collection of Fields Medalists of TSIMF library. They are on display in room A220. The participants are welcome to visit.

Restaurant

All the meals are provided in the Chinese Restaurant (Building B1) according to the time schedule.

Breakfast	07:30-08:30
Lunch	12:00-13:30
Dinner	17:30-19:00

Laundry

Opening Hours: 24 hours

The self-service laundry room is located in the Building 1 (B1).

Gym

The gym is located in the Building 1 (B1), opposite to the reception hall. The gym provides various fitness equipment, as well as pool tables, tennis tables and etc.

Playground

Playground is located on the east of the central gate. There you can play basketball, tennis and badminton. Meanwhile, you can borrow table tennis, basketball, tennis balls and badminton at the reception desk.

Swimming Pool

Please note that there are no lifeguards. We will not be responsible for any accidents or injuries. In case of any injury or any other emergency, please call the reception hall at +86-898-38882828.

Outside Shuttle Service

We have shuttle bus to take participants to the airport for your departure service. Also, we would provide transportation at the Haihong Square （海虹广场） of Howard Johnson for the participants who will stay outside TSIMF. If you have any questions about transportation arrangement, please feel free to contact Ms. Li Ye (叶莉), her cell phone number is (0086)139-7679-8300.

Free Shuttle Bus Service at TSIMF

We provide free shuttle bus for participants and you are always welcome to take our shuttle bus, all you need to do is wave your hands to stop the bus.

Destinations: Conference Building, Reception Room, Restaurant, Swimming Pool, Hotel etc.

Contact Information of Administration Staffs

Location of Conference Affair Office: *Room 104, Building A*
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Shcedule for the International Workshop on Symmetries of Graphs and Networks Jan.29- Feb.2, 2018

Time&Date	Monday (January 29)	Tuesday (January 30)	Wednesday (January 31)	Thursday (February 1)	Friday (February 2)
7:30-8:30	*Breakfast (60 minutes)*				
08:50–09:00	*Opening & Welcome*				
Chair	*Marston Conder*	Steve Wilson	Dragan Marušič	Gabriel Verret	Marston Conder
09:00–09:30	Jozef Širáň	Primož Potočnik	Klavdija Kutnar	Primož Šparl	Problem session
09:30–10:00	Gabriel Verret	Shenglin Zhou	Roman Nedela	Jingjian Li	
10:00-10:30	*Coffee Break (30 minutes)*				
Chair	Yan-Quan Feng	Sanming Zhou	Cheryl Praeger	Shaofei Du	Yan-Quan Feng
10:30–11:00	Joy Morris	Yan-Quan Feng	Shaofei Du	Edward Dobson	Free discussion
11:00–11:30	Binzhou Xia	István Kovács	Young Soo Kwon	Arjana Žitnik	
11:30–12:00	Jin-Xin Zhou	Zaiping Lu	Kan Hu	Wei-Juan Zhang	
12:00-13:30	*Lunch (90 minutes)*				
Chair	Jozef Širáň	Joy Morris	Marston Conder	Roman Nedela	Departure
13:30–14:00	Robert Jajcay	Dragan Marušič	Free Discussion 13:30-17:00 天涯海角	Aleksander Malnič	
14:00–14:30	Steve Wilson	Ademir Hujdurović		Jack Koolen	
14:30–15:00	Sanming Zhou	Wei Jin		Sejeong Bang	
15:00-15:30	*Coffee Break (30 minutes)*			*Coffee Break (30 minutes)*	
Chair	Robert Jajcay	Primož Potočnik		Klavdija Kutnar	Departure
15:30–16:00	Problem session	Cheryl Praeger		Marston Conder	
16:00–16:30		Rong-Xia Hao		Problem session	
16:30–17:00		Jicheng Ma			
17:30-19:00	*Dinner*		Banquet 18:00-20:00	*Dinner*	

International Workshop on Symmetries of Graphs and Networks
29 January – 2 February 2018

Monday 29 January

Morning		
Breakfast (07:30–08:30)		
08:50–09:00	Opening & Welcome (Marston Conder and Yan-Quan Feng)	
Session 1	Chair: Marston Conder	
09:00–09:30	Jozef Širáň	Regular and bi-rotary maps of negative prime characteristic
09:00–09:30	Gabriel Verret	Compatible local actions in arc-transitive digraphs
10:00–10:30	Tea Break	
Session 2	Chair: Yan-Quan Feng	
10:30–11:00	Joy Morris	Cayley index and Most Rigid Representations
11:00–11:30	Binzhou Xia	Graphical regular representations of groups of prescribed valency
11:30–12:00	Jin-Xin Zhou	On weakly symmetric graphs of order twice a prime square
12:00–13:30	Lunch	

Afternoon		
Session 3	Chair: Jozef Širáň	
13:30–14:00	Robert Jajcay	Graphs with large minimal vertex-transitive automorphism groups
14:00–14:30	Steve Wilson	Which of the Praeger-Xu graphs are Cayley?
14:30–15:00	Sanming Zhou	A short survey on perfect codes in Cayley graphs
15:00–15:30	Tea Break	
Session 4	Chair: Robert Jajcay	
15:30–16:00	Problem session	
16:00–16:30	Problem session	
16:30–17:00	Problem session	
17:30–19:00	Dinner	

Tuesday 30 January

Morning		
Breakfast (07:30–08:30)		
Session 1	Chair: Steve Wilson	
09:00–09:30	Primož Potočnik	Controlling the automorphism group of a covering graph
09:30–10:00	Shenglin Zhou	Flag-transitive automorphism groups of 2-designs
10:00–10:30	Tea Break	
Session 2	Chair: Sanming Zhou	
10:30–11:00	Yan-Quan Feng	Symmetric Cayley graphs on non-abelian simple groups with small valencies
11:00–11:30	István Kovács	Elementary abelian groups of rank 5 are DCI-groups
11:30–12:00	Zaiping Lu	On arc-transitive Cayley digraphs of out-valency 3
12:00–13:30	Lunch	

Afternoon		
Session 3	Chair: Joy Morris	
13:30–14:00	Dragan Marušič	Symmetric graphs: why semiregularity matters
14:00–14:30	Ademir Hujdurovič	Odd automorphisms in graphs
14:30–15:00	Wei Jin	Two-distance-primitive graphs
15:00–15:30	Tea Break	
Session 4	Chair: Primož Potočnik	
15:30–16:00	Cheryl Praeger	Edge-transitive oriented graphs of valency four: quotients and cycles
16:00–16:30	Rong-Xia Hao	The directed genus of some digraphs
16:30–17:00	Jicheng Ma	Orientably-regular maps of genus p^2+1
17:30–19:00	Dinner	

Wednesday 31 January

Morning		
Breakfast (07:30–08:30)		
Session 1	Chair: Dragan Marušič	
09:00–09:30	Klavdija Kutnar	On normality of *n*-Cayley graphs
09:30–10:00	Roman Nedela	Density of singular pairs of integers
10:00–10:30	Tea Break	
Session 2	Chair: Cheryl Praeger	
10:30–11:00	Shaofei Du	Skew-morphisms of the cyclic 2-groups
11:00–11:30	Young Soo Kwon	Classification of skew-morphisms and regular Cayley maps for dihedral groups
11:30–12:00	Kan Hu	Smooth skew-morphisms of the dihedral groups
12:00–13:30	Lunch	

Afternoon	
Session 3	Chair: Yan-Quan Feng
13:30–14:00	Free discussion
14:00–14:30	Free discussion
14:30–15:00	Free discussion
15:00–15:30	Tea Break
Session 4	Chair: Marston Conder
15:30–16:00	Free discussion
16:00–16:30	Free discussion
16:30–17:00	Free discussion
18:00–20:00	Banquet

Thursday 1 February

Morning		
Breakfast (07:30–08:30)		
Session 1	Chair: Gabriel Verret	
09:00–09:30	Primož Šparl	On structural results of tetravalent half-arc-transitive graphs
09:30–10:00	Jingjian Li	Symmetric Cayley graphs of prime valency on finite non-abelian simple groups
10:00–10:30	Tea Break	
Session 2	Chair: Shaofei Du	
10:30–11:00	Edward Dobson	On Isomorphism and Multiplier Inequivalence of Cyclic Steiner Quadruple Systems
11:00–11:30	Arjana Žitnik	Chiral astral realizations of cyclic 3-configurations
11:30–12:00	Wei-Juan Zhang	Constructions for chiral polytopes
12:00–13:30	Lunch	

Afternoon		
Session 3	Chair: Roman Nedela	
13:30–14:00	Aleksander Malnič	On reflexible polynomials
14:00–14:30	Jack Koolen	Some recent progress on 2-walk-regular graphs
14:30–15:00	Sejeong Bang	Diameter bounds on geometric distance-regular graphs
15:00–15:30	Tea Break	
Session 4	Chair: Klavdija Kutnar	
15:30–16:00	Marston Conder	Recent developments on edge-transitive graphs and maps
16:00–16:30	Problem session	
16:30–17:00	Problem session	
17:30–19:00	Dinner	

Friday 2 February

Morning		
Breakfast (07:30–08:30)		
Session 1	Chair: Marston Conder	
09:00–09:30	Problem session	
09:30–10:00	Problem session	
10:00–10:30	Tea Break	
Session 2	Chair: Yan-Quan Feng	
10:30–11:00	Free discussion	
11:00–11:30	Free discussion	
11:30–12:00	Free discussion	
12:00–13:30	Lunch	

Titles and Abstracts

1. Sejeong Bang, Yeungnam University, South Korea

Title: Diameter bounds on geometric distance-regular graphs

Abstract: A non-complete distance-regular graph Γ is called geometric if there exists a set of Delsarte cliques $\mathcal{C}$ such that each edge of Γ lies in a unique clique in $\mathcal{C}$. In this talk, we discuss about geometric distance-regular graphs. In particular, we give a diameter bound for geometric distance-regular graphs with smallest eigenvalue $-m$. Moreover, we characterize geometric distance-regular graphs with smallest eigenvalue at least -4.

2. Marston Conder, University of Auckland, New Zealand

Title: Recent developments on edge-transitive graphs and maps

Abstract: In this talk I'll describe some recent discoveries about edge-transitive graphs and edge-transitive maps. These are objects that have received relatively little attention compared with their vertex-transitive and arc-transitive siblings. First I will explain a new approach (taken in joint work with Gabriel Verret) to finding all small edge-transitive graphs using single and twin actions of transitive permutation groups, which has resulted in the determination of all edge-transitive graphs of order up to 47, and all bipartite edge-transitive graphs of order up to 63. Then I'll talk about some recent work on edge-transitive maps, helped along by workshops at Oaxaca and Banff in 2017. I'll explain how such maps can be constructed and analysed, and describe some applications. For example, I'll give the answer to an 18-year-old question by Siran, Tucker and Watkins about whether an orientable surface can carry edge-transitive maps of all 14 types.

3. Edward Dobson, Mississippi State University, USA and University of Primorska, Slovenia

Title: On Isomorphism and Multiplier Inequivalence of Cyclic Steiner Quadruple Systems

Abstract: Two combinatorial objects defined over $\{0, 1, \ldots, v-1\}$ and with a regular cyclic group of automorphisms generated by $(0, 1, \ldots, v-1)$ are said to be multiplier equivalent if one can be mapped onto the other by a permutation $\sigma : i \mapsto si$, where $(s, v) = 1$. In many situations one can prove that the particular objects are isomorphic iff they are multiplier equivalent. Here, the first known examples of cyclic Steiner quadruple systems (CSQSs) that are isomorphic but not multiplier equivalent are presented. Such CSQSs exist only for $v \geq 40$. Infinite families of CSQSs with this property are further obtained.

This is joint work with Tao Feng, Dereck Holt, and Patric Östergård.

4. Shaofei Du, Capital Normal University, China

Title: Skew-morphisms of the cyclic 2-groups

Abstract: A skew-morphism ϕ of a finite group A is a permutation on A fixing the identity element, and for which there exists an integer function π on A such that $\phi(xy) = \phi(x)\phi^{\pi(c)}(y)$ for all $x, y \in A$. In *J. Group Theory, DOI*: `https://doi.org/10.1515/jgth-2017-0015`, Kovacs and Nedela determined skew-morphisms of cyclic p-groups, where p is an odd prime. In this talk we shall determine that of cyclic 2-groups, thus finishing the determination of skew-morphisms of cyclic group of prime power order.

This is a joint work with Kan Hu.

5. Yan-Quan Feng, Beijing Jiaotong University, China

Title: Symmetric Cayley graphs on non-abelian simple groups with small valencies

Abstract: A graph Γ is said to be G-arc-transitive for a group G of automorphisms of Γ, if G acts transitively on the arc set of Γ, and symmetric if it is $\mathrm{Aut}(\Gamma)$-arc-transitive. Let Γ be a finite connected symmetric graph and let $G \leq \mathrm{Aut}(\Gamma)$ be a non-abelian simple group. In this talk, we show that if Γ is a tetravalent 2-arc-transitive Cayley graph on G, then either $G \trianglelefteq \mathrm{Aut}(\Gamma)$ or $\mathrm{Aut}(\Gamma)$ contains a non-abelian simple normal subgroup T such that $G < T$ and (G, T) is one of 7 possible pairs of non-abelian simple groups. If Γ is a pentavalent symmetric Cayley graph on G, then either $G \trianglelefteq \mathrm{Aut}(\Gamma)$ or $\mathrm{Aut}(\Gamma)$ contains a non-abelian simple normal subgroup T such that $G < T$ and (G, T) is one of 13 possible pairs of non-abelian simple groups.

6. Rong-Xia Hao, Beijing Jiaotong University, China

Title: The directed genus of some digraphs

Abstract: Although there are some results about embedding genus and the genus distributions of graphs in orientable surfaces, little is known about those of digraphs. The problem that "Which tournaments on n vertices have directed genus $\lceil \frac{(n-3)(n-4)}{12} \rceil$, the genus of K_n?" were given by C.P. Bonnington, M. Conder, and M. Morton in [*J. of Combin. Theory, B* 85(2002)1-20]. In this talk, we will introduce some progress on directed genus of some digraphs and tournaments.

7. Kan Hu, Zhejiang Ocean University, China

Title: Smooth skew-morphisms of the dihedral groups

Abstract:A skew-morphism of a finite group A is a permutation φ fixing the identity element of A, and for which there exists an integer function π on A such that $\varphi(xy) = \varphi(x)\varphi^{\pi(x)}(y)$ for all $x, y \in A$. It is well known that the kernel $\mathrm{Ker}\,\varphi$ of φ defined by $\mathrm{Ker}\,\varphi = \{x \in A \mid \pi(x) = 1\}$ is a subgroup of A. In general $\mathrm{Ker}\,\varphi$ does not have to be preserved by φ, but if it does then the skew-morphism will be called kernel-preserving. A kernel-preserving skew-morphism φ of A is termed smooth (or coset-preserving) if $\pi(x) = \pi(\varphi(x))$ for all $x \in A$. Thus smooth skew-morphisms generalize the well-studied t-balanced skew-morphisms. In this talk I will present some important properties of smooth skew-morphisms. In particular we show that for each kernel-preserving skew-morphism φ of order n there exists a proper factor m of n such that φ^m is smooth. Depending on the theory we present a classification of smooth skew-morphisms of the dihedral groups.

8. Ademir Hujdurović, University of Primorska, Slovenia

Title: Odd automorphisms in graphs

Abstract: An automorphism of a graph is said to be even/odd if it acts on the vertex set of the graph as an even/odd permutation. In this talk, I will present the formula for the number of non-isomorphic graphs of order n admitting an odd automorphism, together with some asymptotic estimates. We will then focus on the existence of odd automorphisms in the class of vertex-transitive graphs. A positive integer n is a Cayley number if every vertex-transitive graph of order n is a Cayley graph. By analogy, a positive integer n is said to be a vertex-transitive-odd number (in short, a VTO-number) if every vertex-transitive graph of order n admits an odd automorphism. We will prove that Cayley numbers congruent to 2 modulo 4, cube-free nilpotent Cayley numbers congruent to 3 modulo 4, and numbers of the form $2p$, for p a prime, are VTO numbers. At the other extreme, it is possible that the complete graph K_n is the only connected vertex-transitive graph of order $n > 2$ admitting an odd automorphism. We will prove that this happens if and only if n is a Fermat prime.

This is joint work with Klavdija Kutnar and Dragan Marušič.

9. Robert Jajcay, Comenius University and University of Primorska, Slovenia

Title: Graphs with large minimal vertex-transitive automorphism groups

Abstract: We focus on families of vertex-transitive graphs that are far from being Cayley in the sense that the smallest vertex-transitive automorphism groups of these graphs are considerably bigger than the orders of the corresponding graphs. We present several families of highly symmetric graphs, investigate which of the graphs in these families are far from being Cayley, and also address the question how to obtain infinite families of graphs for which the ratio between the order of a smallest vertex-transitive automorphism group and the order of the graph grows to infinity.

10. Wei Jin, Jiangxi University of Finance and Economics Nanchang, China

Title: Two-distance-primitive graphs

Abstract: A 2-distance-primitive graph is a vertex-transitive graph whose vertex stabilizer is primitive on both the first step and the second step neighborhoods. Let Γ be such a graph. In this talk, we will show that either Γ is a cyclic graph, or Γ is a complete bipartite graph, or Γ has girth at most 4 and the vertex stabilizer acts faithfully on both the first step and the second step neighborhoods. We will also give a complete classification of such graphs satisfying that the vertex stabilizer acts 2-transitively on the second step neighborhood.

11. Jack Koolen, University of Science and Technology of China, China

Title: Some recent progress on 2-walk-regular graphs

Abstract: 2-walk-regular graphs are a combinatorial generalisation of vertex-transitive graphs in which any point stabiliser acts transitively on the neighbourhood and the second neighbourhood of it. For example 2-arc-transitive graphs are 2-walk-regular.

But also the cubic 1-arc-transitive graphs are 2-walk-regular. In this talk I will discuss some recent progress on 2-walk-regular graphs.

12. István Kovács, University of Primorska, Slovenia

Title: Elementary abelian groups of rank 5 are DCI-groups

Abstract: A subset S of a finite group G is called a CI-subset if whenever the Cayley digraph $\mathrm{Cay}(G,S)$ is isomorphic to $\mathrm{Cay}(G,T)$ for a subset T, it follows that $T=S^{\alpha}$ with some automorphism α of G. The group G is called a DCI-group if all its subsets are CI-subsets, and it is called a CI-group if all its inverse closed subsets are CI-subsets. In 1978, Babai and Frankl asked the following question: Which are the CI-groups? The problem of determining all CI- and DCI-groups is still wide open, and in my talk I will focus on the special case when G is an elementary abelian p-group. It was proved earlier that G is a DCI-group if its rank is at most 4. On the other, a non-CI-subset was found for the elementary abelian 2-group of rank 6. In the talk, I will present a proof for elementary abelian p-groups of rank 5 to be DCI-groups for any odd prime p.

This is a joint work with Yan-Quan Feng.

13. Klavdija Kutnar, University of Primorska, Slovenia

Title: On normality of n-Cayley graphs

Abstract: Let G be a finite group and X a graph. If there exists a semiregular subgroup $\bar{G}$ of the automorphism group Aut(X) isomorphic to G with n orbits on $V(X)$ then the graph X is called an *n-Cayley graph on G*. If, in addition, this subgroup $\bar{G}$ is normal in Aut(X) then X is called a *normal n-Cayley graph on G*.

In this talk I will present a recent result that every finite group admits a normal n-Cayley graph for every $n \geq 2$.

This is a joint work with Ademir Hujdurović and Dragan Marušič.

14. Young Soo Kwon, Yeungnam University, South Korea

Title: Classification of skew-morphisms and regular Cayley maps for dihedral groups

Abstract: A skew-morphism of a group G is a generalization of a group automorphism. It is naturally appeared in a group which is a complementary product of G and a cyclic group. A graph embedding of a graph Γ into a closed surface is called a Cayley map for a group G if there is a subgroup of $\mathrm{Aut}(\Gamma)$ which is isomorphic to G and acts regularly on the vertices of Γ in the embedding. Furthermore the graph embedding is called regular Cayley map for G if the map(embedding) automorphism group acts transitively on the arc set of Γ in the embeddings. It is known that there is a one-to-one relation between regular Cayley map for G and a set of skew-morphisms of G satisfying some conditions. In this talk, we consider full classification of skew-morphisms and regular Cayley maps for dihedral groups are considered.

15. Jingjian Li, Guangxi University, China

Title: Symmetric Cayley graphs of prime valency on finite non-abelian simple groups

Abstract: Normality of Cayley graphs on finite non-abelian simple groups has received considerable attention. In 1996, Li listed all possible finite non-abelian simple groups on which a connected cubic symmetric Cayley graph might be non-normal. Li's list was later made explicit by Xu, Fang, Wang and Xu in [*European J. Combin.* 26 (2005) 133–143], who showed that there exists a connected cubic symmetric non-normal Cayley graph on a finite non-abelian simple group G if and only if $G = \mathrm{A}_{47}$. For connected pentavalent symmetric non-normal Cayley graphs on finite non-abelian groups, Fang, Ma and Wang first gave a characterization in [*J. Combin. Theory Ser. A*, 118 (2011), 1039–1051]. Then recently Du, Feng and Zhou in [*European J. Combin.* 63 (2017), 134–145] obtained a list of all possible such non-abelian simple groups. To extend the above results to symmetric Cayley graphs of prime valency p on non-abelian simple groups, we deal with the case when $p \geqslant 7$. Our main aim of this talk is to give a characterization of the automorphism groups of connected symmetric Cayley graphs of prime valency on finite non-abelian simple groups.

16. Zai Ping Lu, Nankai University, China

Title: On arc-transitive Cayley digraph of out-valency 3

Abstract: In this talk, we introduce a classification result on arc-transitive Cayley digraphs of finite simple groups with out-valency 3. Let $\Gamma = \mathrm{Cay(G, S)}$ be an arc-transitive Cayley digraph of a finite group G with $S \neq S^{-1}$ and $G = \langle SS^{-1} \rangle$. Then either G is normal in $\mathrm{Aut}\Gamma$, or G contains a normal subgroup N of $\mathrm{Aut}\Gamma$ such that the pair $(G/N, \mathrm{Aut}\Gamma/\mathrm{N})$ is isomorphic to one of $(\mathbb{Z}_4, \mathrm{S}_4)$, $(\mathbb{Z}_{11}{:}\mathbb{Z}_5, \mathrm{PSL}(2, 11))$ and $(\mathrm{A}_{47}, \mathrm{A}_{48})$. In particular, for a finite simple group G, if G is not normal in $\mathrm{Aut}\Gamma$, then Γ is isomorphic to one of 1088 Cayley digraphs of A_{47}.

17. Jicheng Ma, Chongqing University of Arts and Sciences, China

Title: Orientably-regular maps of genus $p^2 + 1$

Abstract: In this talk, I will introduce a recent classification of orientably-regular maps of genus $p^2 + 1$ for prime p. As a result, this gives some ideas of constructing orientably-regular maps of genus g congruent to 2 mod 6 as $p^2 + 1$ congruent to 2 mod 6 for $p > 3$.

18. Aleksander Malnič, University of Ljubljana and University of Primorska, Slovenia,

Title: On reflexible polynomials

Abstract: A polynomial $f(x) = a_0 + a_1x + \ldots + a_nx^n$ over the prime field $\mathbb{Z}_p$, where p is odd, is reflexible if there exists $\lambda \in \mathbb{Z}_p^*$ such that $\lambda a_{n-i} = a_i$ (type 1) or $\lambda a_{n-i} = (-1)^i a_i$ (type 2), for all indices $i = 0, 1, \ldots, n$. Such polynomials were instrumental in the classification of quartic arc transitive graphs arising as minimal elementary abelian covers of doubled cycles, a problem that stems from an old result of Gardiner and Praeger. Joint work with Boštjan Kuzman and Primož Potočnik.

19. Dragan Marušič, University of Primorska, Slovenia,

Title: Symmetric graphs: why semiregularity matters

Abstract: In this talk I will discuss the still open problem of existence of semiregular automorphisms in vertex-transitive (di)graphs (that is, a non-identity automorphism with all orbits of the same size) and its generalization to 2-closed groups. In particular, I will focus on the importance of the semiregular automorphism to various other open problems in graph theory.

20. Joy Morris, University of Lethbridge, Canada

Title: Cayley index and Most Rigid Representations (MRRs)

Abstract: For any finite group G, a natural question to ask is the order of the smallest possible automorphism group for a Cayley graph on G. A particular Cayley graph whose automorphism group has this order is referred to as an MRR (Most Rigid Representation), and its Cayley index (as well as the Cayley index of that group) is the index of the regular representation of G in the automorphism group. Study of GRRs (Graphical Regular Representations, where the full automorphism group is the regular representation of G) showed that with the exception of two infinite families and ten individual groups, every group admits a Cayley graph whose MRRs are GRRs, so that the Cayley index is 1. I will present results that complete the determination of the Cayley index for those groups whose Cayley index is greater than 1.

This is based on joint work with Josh Tymburski.

21. Roman Nedela, Slovak Academy of Science, Slovakia

Title: Density of singular pairs of integers

Abstract: A positive integer n is called cyclic if there is a unique group of order n, which is necessarily cyclic. Using a characterisation of the cyclic integers as those n satisfying $\gcd(n, \varphi(n)) = 1$, P. Erdős (1947) proved that the number of cyclic integers $n \leq x$ is asymptotic to $z(x) = e^{-\gamma}\frac{x}{\log\log\log x}$, as $x \to \infty$, where γ is Euler's constant. An ordered pair of integers (m, n) is called singular if $\gcd(m, \varphi(n)) = 1$ and $\gcd(n, \varphi(m)) = 1$. We show that the number of singular pairs of integers (m, n), $m, n \leq x$, is asymptotic to $z(x)^2$. The concept of singular pairs of integers is relevant to pairwise products of cyclic groups and to edge-transitive embeddings of complete bipartite graphs. In particular, the following result was proved by Y.Q. Feng, Kan Hu, R. Nedela, M. Skoviera and N. Wang.

Theorem. Let m and n be positive integers. Then the following statements are equivalent:

(1) the pair (m, n) is singular,
(2) every product of disjoint cyclic groups C_m and C_n of orders m and n is the direct product $C_m \times C_n$,
(3) every product of cyclic groups of orders m and n is abelian,
(4) the complete bipartite graph $K_{m,n}$ admits a unique edge-transitive embedding into an orientable surface.

22. Primož Potočnik, University of Milano-Bicocca, Italy

Title: Controlling the automorphism group of a covering graph

Abstract: Given a regular covering projection between two connected graphs, one of the central question is what is the relationship between the automorphism groups of these two graphs. It is well-known that the covering graph may possess automorphisms that do not project to automorphisms of the base graph and also that the base graph may have automorphisms that do not lift to automorphisms of the covering graph. In this talk the following problem will be addressed: Given a connected finite graph X and a group of automorphisms G acting upon X, does there exist a regular covering projection to X such that the maximal group that lifts is G. We will present a recent result by Pablo Spiga and myself that shows that under some mild conditions on G and X the answer to this question is always affirmative. We will then also discuss the question whether the covering projection can be chosen in such a way that the full automorphism group of the covering graph equals the lift of the group G.

23. Cheryl Praeger, University of Western Australia, Australia

Title: Edge-transitive oriented graphs of valency four: quotients and cycles

Abstract: I will report on our analysis of the structure of this family of oriented graphs in terms of their quotients — especially their cyclic normal quotients. This approach gives new insights, and makes possible various classifications. It identifies three kinds of basic examples: quasiprimitive, bi-quasiprimitive, and cyclic types. The analysis of the basic quasiprimitive type is satisfactory. That for the other two basic types would be suitable for a project during the workshop. For the third type, we have shown that all basic examples with independent cyclic normal quotients are known and come from one of five explicit families. (Graphs from most of these five families had previously been used in the literature to illustrate various local properties.)

Collaborators: joint work with Jehan Al-bar, Ahman Al-kenani and Najat Muthana.

24. Jozef Širáň, Open University and Slovak University of Technology, Slovakia

Title: Regular and bi-rotary maps of negative prime characteristic

Abstract: Pseudo-orientable maps were introduced by Steve Wilson in the seventies to describe non-orientable maps with the property that opposite orientations can consistently be assigned to pairs of adjacent vertices. In this talk we will focus on the pseudo-orientable maps with the property that the local-orientation-preserving automorphism group of the map acts regularly on arcs; we call such maps *bi-rotary*. Our main result is a classification of bi-rotary maps of negative prime Euler characteristic.

25. Primož Šparl, University of Ljubljana, Slovenia

Title: On structural results of tetravalent half-arc-transitive graphs

Abstract: In 1998 Marušič introduced the notions of alternating cycles and attachment sets for tetravalent graphs admitting a half-arc-transitive group of automorphisms, giving rise to two parameters of such graphs, called the radius and the attachment number. These concepts enabled a very fruitful structural approach to the study of tetravalent graphs admitting a half-arc-transitive group of automorphisms. Over the last two decades several important results stemming from this line of work

have been obtained, most notably the classification of the tightly attached tetravalent half-arc-transitive graphs. In this talk we present several recent structural results on tetravalent graphs admitting a half-arc-transitive group of automorphisms, based on the alternating cycles-attachment sets paradigm. We present results on the so-called graph of alternating cycles, the quotient graph with respect to the attachment sets, and introduce a new parameter of such graphs, giving a further insight into their structure, and as a consequence enabling interesting new results on tetravalent half-arc-transitive graphs.

26. Gabriel Verret, University of Auckland, New Zealand

Title: Compatible local actions in arc-transitive digraphs

Abstract: Given a G-arc-transitive graph, the local action is the permutation group induced by a vertex-stabiliser G_v on the neighbourhood of v. It plays an extremely important role in the study of these objects. The situation for digraphs is a little more complicated. One can consider both the in- and out-local-action, that is, the permutation group induced by a vertex-stabiliser on the corresponding in- and out-neighbourhood, respectively. Perhaps surprisingly, these two permutation groups need not be isomorphic, they may not even have the same order. We say that two permutation groups are compatible if they arise in this way, that is, as the in- and out-local action of some finite G-arc-transitive digraph. We will discuss the problem of characterising compatible permutation groups.

27. Steve Wilson, Northern Arizona University, USA

Title: Which Of The Praeger-Xu Graphs are Cayley?

Abstract: We discuss the tetravalent members of a family of graphs, called Praeger-Xu graphs and denoted $PX(n,k)$ here, introduced by C.F.Praeger and M.Y. Xu in 1989. These tetravalent graphs are distinguished by having large symmetry groups; their vertex-stabilizers can be larger (arbitrarily larger) then the number of vertices in the graph. This talk classifies those of this family which are Cayley, classifies the groups under which those are Cayley, and shows that every $PX(n,k)$ is quasi-Cayley.

28. Binzhou Xia, University of Western Australia, Australia

Title: Graphical regular representations of groups of prescribed valency

Abstract: The problem of whether a group can be represented as the automorphism group of a graph was considered at a very early stage of graph theory. If a group G is isomorphic to the automorphism group of a Cayley graph Γ of G, then Γ is said to be a graphical regular representation (GRR) of G. In this talk I will discuss GRRs of prescribed valency, especially those of finite simple groups.

29. Weijuan Zhang, Sun Yat-sen University, China

Title: Constructions for chiral polytopes

Abstract: Abstract polytopes are combinatorial structure obeying certain axioms that generalise both classical convex geometric polytopes and maps on surfaces. Of

particular interest are the polytopes with maximal possible symmetry subject to certain natural constraints. Chiral polytopes are abstract polytopes which have maximal rotational symmetry but no reflection, in contrast to the regular polytopes which have maximal symmetry by reflection. Examples of chiral polytopes have been difficult to find. In this talk, we will introduce the study of chiral polytopes briefly, and present some methods for constructing chiral polytopes.

This joint work with my supervisor Marston Conder was done during the course of PhD in the past years.

30. Jin-Xin Zhou, Beijing Jiaotong University, China

Title: On weakly symmetric graphs of order twice a prime square

Abstract: A graph is weakly symmetric if its automorphism group is both vertex-transitive and edge-transitive. In 1971, Chao characterized all weakly symmetric graphs of prime order and showed that such graphs are also arc-transitive. In 1987, Cheng and Oxley determined all weakly symmetric graphs of order twice a prime and showed that these graphs are arc-transitive, too. In this paper, a characterization of weakly symmetric graphs of order twice a prime square is given, and it shows that these graphs are also arc-transitive.

31. Sanming Zhou, The University of Melbourne, Australia

Title: A short survey on perfect codes in Cayley graphs

Abstract: Let $G = (V, E)$ be a graph and t a positive integer. A perfect t-code in G is a subset C of V such that every vertex of G is at distance no more than t to exactly one vertex in C. Perfect t-codes in the Hamming graph $H(n, q)$ are precisely q-ary perfect t-codes of length n in the classical setting, and those in the Cartesian product $C_q\Box \cdots \Box C_q$ of cycle C_q with itself n times are precisely q-ary perfect t-codes of length n under the Lee metric. A perfect 1-code in a graph is also called an efficient dominating set or independent perfect dominating set of the graph.

Perfect codes in Cayley graphs are a generalization of perfect codes under the Hamming or Lee metric, and perfect 1-codes in Cayley graphs are closely related to tilings of the underlying groups. In this talk I will give a short survey of perfect codes in Cayley graphs, with an emphasis on perfect 1-codes.

32. Shenglin Zhou, South China University of Technology, China

Title: Flag-transitive automorphism groups of 2-designs

Abstract: Let $\mathcal{D}$ be a 2-(v, k, λ) design. A flag of $\mathcal{D}$ is an incident point-block pair. The group $G \leq Aut(\mathcal{D})$ is called flag-transitive if G acts transitively on the set of flags of $\mathcal{D}$. There has been extensive research on flag-transitive 2-designs, especially for symmetric case. In this talk, we will report some new results, including flag-transitive symmetric 2-designs with the condition that λ small, r and λ co-prime, or $\lambda \geq (r, \lambda)^2$, as well as some new classification on flag-transitive non-symmetric 2-designs.

33. Arjana Žitnik, University of Ljubljana and IMFM, Slovenia

Title: Chiral astral realizations of cyclic 3-configurations

Abstract: A combinatorial (n_k) configuration is cyclic if it admits an automorphism of order n that permutes its points and lines, respectively. A geometric configuration (n_3) is astral if both points and lines form two orbits under the group of symmetries of the configuration. This is the largest amount of symmetry any geometric (n_3) configuration can possess.

Branko Grünbaum has shown that in the plane, only cyclic and dihedral symmetry come into question. We consider the problem of geometric realization of combinatorial cyclic $(2m_3)$ configurations as astral configurations with cyclic symmetry. We provide methods for producing such geometric realizations for many classes of cyclic $(2m_3)$ configurations and we also show that there are infinitely many cyclic $(2m_3)$ configurations which cannot be geometrically realized as astral configurations with cyclic symmetry.