Doctoral Program Discrete Mathematics

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DK Day 2017

Thursday, December 14, 2017

TU Graz, Steyrergasse 30,
Lecture Hall BE01 (ground floor)

Schedule and abstracts

$10:30 - 10:40$ **Opening**
Presentation of the Doctoral Program Discrete Mathematics

$10:40 - 11:30$ **Talk by Dr. Christopher Frei (University of Manchester)**
Title: Bounds for l-torsion in class groups

Abstract: The arithmetic of a number field is determined in large parts by its class group. While it is a classical result of algebraic number theory that this group is always a finite and abelian, precise information on its structure remains quite elusive. To emphasise how little we know, it is still unknown whether the class group is trivial for infinitely many number fields. In this talk, we introduce class groups and survey classical and recent results (conditional and unconditional) bounding the cardinality of their l-torsion subgroups, for a natural number l. In the remaining time, we discuss recent joint work with Martin Widmer on average bounds for this l-torsion in certain families of number fields.

$11:30 - 11:40$ **Math.Video**

$11:45 - 12:15$ **Talk by JunSeok Oh (DK-Project 03)**
Title: Product-one sequences over finite groups

Abstract: Let G be a finite group. By a sequence over G, we mean a finite sequence of terms from G which is unordered, repetition of terms allowed, and we say that it is a product-one sequence if its terms can be ordered such that their product equals the identity element of G. We denote by $\mathcal{B}(G)$ the set of all product-one sequences over G. We study the algebraic properties of $\mathcal{B}(G)$ by means of the class semigroup, among others we show that $\mathcal{B}(G)$ is seminormal monoid if and only if its class semigroup is Clifford semigroup. We also study the arithmetic of $\mathcal{B}(G)$, for instance the Davenport constant and the sets of lengths, among others we show that union of sets of lengths are finite intervals.

$12:15 - 12:25$ **Math.Video**

$12:25 - 13:45$ **Lunch break** - warm buffet in front of HS BE01 (for all participants!)

$13:45-14:15$ **Talk by Shuqin Zhang (DK-Project 08)**

Title: Topology of a class of $p2$-crystallographic replication tiles.

Abstract: We study the topological properties of a class of planar crystallographic replication tiles. Let $M \in \mathbb{Z}^{2\times 2}$ be an expanding matrix with characteristic polynomial x^2+Ax+B ($A, B \in \mathbb{Z}$, $B \geq 2$) and $\mathbf{v} \in \mathbb{Z}^2$ such that $(\mathbf{v}, M\mathbf{v})$ are linearly independent. Then the equation $MT + \frac{B-1}{2}\mathbf{v} = T \cup (T+\mathbf{v}) \cup (T+2\mathbf{v}) \cup \cdots \cup (T+(B-2)\mathbf{v}) \cup (-T)$ defines a unique nonempty compact set T satisfying $\overline{T^\circ} = T$. Moreover, T tiles the plane by the crystallographic group $p2$ generated by the π-rotation and the translations by integer vectors. It was proved by Leung and Lau in the context of self-affine lattice tiles with collinear digit set that $T \cup (-T)$ is homeomorphic to a closed disk if and only if $2|A| < B+3$. However, this characterization does not hold anymore for T itself. In this paper, we completely characterize the tiles T of this class that are homeomorphic to a closed disk.

$14:15-14:25$ **Math.Video**

$14:30-15:00$ **Talk by Irene de Parada (DK-Project 11)**

Title: On simple and semi-simple drawings of the complete graph.

Abstract: We consider rotation systems and simple and semi-simple drawings of K_n. A simple drawing of a graph is a drawing in which every pair of edges intersects in at most one point. In a semi-simple drawing, edge pairs might intersect in multiple points, but incident edges only intersect in their common endpoint. For semi-simple drawings we present a generalization of Conway's Thrackle Conjecture and obtain tight bounds, settling the question for those drawings.
A rotation system is called (semi-)realizable if it can be realized with a (semi-)simple drawing. We study the problem of checking realizability and semi-realizability of rotation systems.

$15:00-15:10$ **Math.Video**

$15:10-15:40$ **Coffee break**

$15:40-16:30$ **Talk by Prof. Dr. Silke Rolles (Technische Universität München)**

Title: Processes with reinforcement

Abstract: Vertex-reinforced jump processes have a preference to jump to sites they have visited in the past. Sabot and Tarres discovered that the discrete time process associated with the vertex-reinforced jump process is a mixture of Markov chains. Surprisingly, the mixing measure can be expressed in terms of a nonlinear hyperbolic supersymmetric sigma model, which was introduced by Zirnbauer in a completely different context. In the talk I will explain these connections and show a natural extension of Zirnbauer's model. The talk is based on joint work with Franz Merkl and Pierre Tarres.

$16:30-16:40$ **Math.Video**