

Alps-Adria Seminar on Algebra and Analysis

11th meeting

Graz, May 30, 2026

Technische Universität Graz
Kopernikusgasse 24
8010 Graz, Austria

Schedule

All talks will take place in Hörsaal A, room NT01004, 1st floor

10:00–10:25 Eduard Stefanescu: *Maximal gap distribution and infinite covering*

10:30–10:55 Adrian Beker: *The Rényi entropy of the order of a random permutation*

11:00–11:25 Marco Barbieri: *Strong convergence of random permutational representations*

Coffee break

12:00–12:25 Martin Jesenko: *Infinite pinning of interfaces in a random elastic medium*

12:30–12:55 Neven Grbac: *On the structure of spaces of automorphic forms*

13:00–13:25 Roswitha Rissner: *Stabilization of associated primes of monomial ideals*

14:00– Lunch at Himalaya Masala, Grazbachgasse 35

Abstracts

Marco Barbieri (University of Ljubljana)

Strong convergence of random permutational representations

A family of d -regular graphs is called an expander family if their adjacency matrices exhibit a spectral gap between the trivial eigenvalue d and the rest of the spectrum. This seemingly simple condition has far-reaching consequences, from rapid mixing of random walks to strong metric properties. On a seemingly different note, a sequence of random matrices is said to strongly converge to an operator if, with high probability, the norms of these matrices converge to the operator norm of the limiting object. This notion has recently found powerful applications in expansion problems, both in graph theory and in hyperbolic geometry. In this talk, we will explore the connection between these two notions, and we will show how strong convergence of random permutational representations of symmetric groups leads to new probabilistic constructions of expanders. This is joint work with Urban Jezernik.

Adrian Beker (University of Zagreb)

The Rényi entropy of the order of a random permutation

The study of the order of a random permutation is a fundamental problem in probabilistic group theory. Its global behaviour is well understood: a classical result of Erdős and Turán shows that the logarithm of the order is asymptotically normally distributed. We consider two local questions: what is the most probable order of a random permutation of $\{1, \dots, n\}$, and with what probability does it occur? What is the probability that two independent random permutations have equal orders? The former goes back to work of Erdős and Turán, while the latter was recently studied by Acan, Burnette, Eberhard, Schmutz and Thomas. We give an essentially complete answer to these questions by analysing the associated concept of Rényi entropy. Our results are quantitatively optimal and reveal a tight connection between the asymptotic behaviour of the quantities in question and number-theoretic properties of n .

Neven Grbac (Juraj Dobrila University of Pula)
On the structure of spaces of automorphic forms

The Langlands program, proposed by Robert P. Langlands in the 1970s, is a deep web of conjectures relating analysis, geometry and number theory, aligned with certain algebraic structures. On the analytic side, one of the fundamental objects in the Langlands program are automorphic forms on adelic reductive groups. The algebraic structure of spaces of such automorphic forms is described in terms of representation theory by the Franke filtration. The Franke filtration of the space of automorphic forms on a reductive group, with a fixed cuspidal support, is a finite descending filtration whose consecutive quotients are parabolically induced automorphic representations. The explicit form of the Franke filtration, required in many applications such as computation of cohomology of arithmetic groups, is often difficult to grasp because it depends on fine arithmetic information related to Eisenstein series and automorphic L -functions. In this talk, a brief overview of previous applications of the Franke filtration, and certain new research directions in this regard, will be presented. This work is supported by the Croatian Science Foundation under the project HRZZ-IP-2022-10-4615. This work is funded by the EU NextGeneration under the Juraj Dobrila University of Pula institutional research projects number IIP UNIPU 010159 and IIP UNIPU 010162.

Martin Jesenko (IMFM, University of Ljubljana)
Infinite pinning of interfaces in a random elastic medium

Moving of interfaces in a field of obstacles is modelled by the semilinear parabolic equation

$$\frac{\partial u}{\partial t} = \Delta u - f(x, u) + F$$

where $F > 0$ is a constant driving force and f gives the strength and position of obstacles. In the periodic setting, a critical force F_* exists such that for $0 < F < F_*$ there exist stationary solutions whereas for $F > F_*$ there are spatially periodic solutions with positive velocity. Hence, at F_* there is a border between the pinning and the depinning behaviour.

We will consider a random environment of obstacles and explore the question of infinite pinning, i.e., the environment in which for any driving force $F > 0$ the interface gets pinned. We will present a construction of suitable stationary supersolutions and determine a necessary lower bound on the distribution of strengths of obstacles.

Roswitha Rissner (Alpen-Adria Universität Klagenfurt)
Stabilization of associated primes of monomial ideals

In her 1921 work, Emmy Noether established that every ideal in a Noetherian commutative ring admits an irredundant primary decomposition, that is, it can be written as an intersection of primary ideals. Although such decompositions are not unique, the collection of radicals of the primary components—the set of associated primes of the ideal—is uniquely determined. These associated primes may be viewed as the “building blocks” of the ideal or of the mathematical object it encodes: familiar examples include the prime factors of an integer and the irreducible components of an algebraic variety.

We differentiate between two types of associated primes, the minimal and the embedded ones. While the minimal primes are stable under exponentiation, the embedded primes behave erratically. Despite this volatility, a theorem of Brodmann (1979) guarantees eventual stabilization and the power at which the stabilization occurs is called the stability index.

This talk surveys known results on the stability index, with an emphasis on monomial ideals, and reports on ongoing joint work with Jutta Rath. Monomial ideals play an important role in combinatorial commutative algebra. For example, the minimal vertex covers of a (simple, undirected) graph define a monomial ideal I —the cover ideal—whose associated primes are in one-to-one correspondence to the edges of the graph. The associated primes of powers of the cover ideal are intrinsically connected to coloring properties of the graph.

Eduard Stefanescu (Technische Universität Graz)
Maximal gap distribution and infinite covering

Let $(a_n)_{n \in \mathbb{N}}$ be a lacunary sequence of integers satisfying the Hadamard gap condition. For any fixed dimension $d \geq 1$, we establish asymptotic upper bounds for the maximal gap in the set of dilates $\{\alpha a_n\}_{n \leq N}$ modulo 1 as $N \rightarrow \infty$, for Lebesgue-almost all dilation vectors $\alpha \in [0, 1]^d$. More precisely, we prove that for any lacunary $(a_n)_{n \in \mathbb{N}}$ and Lebesgue-almost all α , every convex set in $[0, 1]^d$ of volume at least $(\log N)^2/N$ must contain an element of the set $\{\alpha a_n\}_{n \leq N} \bmod 1$, for all sufficiently large N . We also establish a generalized version of this result, where the d -dimensional Lebesgue measure is replaced by a general measure satisfying a certain Fourier decay condition. Our result is optimal up to logarithmic factors, and recovers as a special case a recent result for dimension $d = 1$. Finally, we show an improved upper bound in the inhomogeneous version of Littlewood-Cassels problem in multiplicative Diophantine approximation.