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Συντονιστές: Μ. Ηλιοπούλου, Μ. Κολουντζάκης, Θ. Μήτσης, Ο. Μπάκας

Ομιλητές

Αθανάσιος Ζαχαρόπουλος (Aarhus University)

The initial-to-final-state inverse problem

In this talk we will explain why one can solve an initial value problem for the Schrödinger equation with time-independent potential V, ignoring the exact Hamiltonian $-\Delta + V$ if enough data, regarding initial and final states, are available.

This is part of a joint work with M. Cañizares, P. Caro and I. Parissis.

Στέφανος Λάππας (Charles University, Prague)

Sharp bilinear estimates for singular integral operators and their maximal counterparts with kernels in weighted spaces

We discuss the boundedness properties of bilinear singular integral operators (including their maximal versions) associated with rough homogeneous kernels on $\mathbb{R}$. In particular, we focus on the $L^{p_1}(\mathbb{R}) \times L^{p_2}(\mathbb{R}) \to L^{p}(\mathbb{R})$ bounds in the optimal quasi-Banach range of exponents $1 < p_1, p_2 < \infty$ and $1/2 < p < \infty$, when the angular component Ω of the kernel belongs to weighted L^q-spaces on the unit sphere $\mathbb{S}^1$ and has vanishing integral.

The talk is based on two joint works with Petr Honzík, Lenka Slavíková and Bae Jun Park.

Έφη Παπαγεωργίου (Universität Paderborn)

ℓ^p asymptotic behavior of isotropic transition densities on homogeneous trees

We study the large-time ℓ^p behavior of transition densities of an isotropic random walk in homogeneous trees, which are infinite, connected, acyclic graphs in which every vertex has the same degree, and can be thought as discrete counterparts of hyperbolic space. Caloric functions of interest are then convolutions of these transition densities with a finitely supported initial condition, and we are interested in their large time behavior in ℓ^p norm.

For each $p \in [1, \infty]$, we introduce a notion of a p-mass function and prove that caloric functions with compactly supported initial data, asymptotically decouple as the product of this mass function the transition density. Using tools of Fourier analysis available on such graphs, we show that this function even boils down to a constant, still depending on p, if the initial condition is radial, that is, depends only on the distance to the origin. Determining the spatial concentration of the densities in p-norm plays an important role, in turn clarifying the interplay between the exponential volume growth of the graph and heat diffusion. The results extend to affine buildings, even exotic ones beyond the Bruhat–Tits framework.

Joint work with B. Trojan.

Μιχαήλ Παπαρίζος (Michigan State University)

On mapping properties of the Lax-Phillips Transform

Lax and Phillips introduced a time dependent approach to scattering based on the properties of the classical wave equation. In this approach, the Lax-Phillips transform, a modified Radon transform plays a central role. They showed that $\mathrm{LP} : \dot{W}^{1,2}(\mathbb{R}^n) \times L^2(\mathbb{R}^n) \to L^2(\mathbb{R} \times \mathbb{S}^{n-1})$ is an ismometric isomorphism. In this talk we discuss more mapping properties of the Lax-Phillips transform on more general type of product spaces, involving Sobolev spaces. We extend their result by proving, among others, that

$$\mathrm{LP} : \dot{W}^{1,p}(\mathbb{R}^n) \times L^p(\mathbb{R}^n) \to L^q(L^r)(\mathbb{R} \times \mathbb{S}^{n-1})$$

is a bounded map, for certain p, q, r.

Μάνος Σπυριδάκης (Πανεπιστήμιο Κρήτης)

Bounded Lattice tiles that pack with another lattice

Suppose L, M are full-rank lattices in Euclidean space, such that $\mathrm{vol}(L) < \mathrm{vol}(M)$. Answering a question of Han and Wang from 2001, we show how to construct a bounded measurable set F (we can even take F to be a finite union of polytopes) such that $F + L$ is a tiling and $F + M$ is a packing.

Joint work with S. Grepstad and M. Kolountzakis.

Βαλέρια Φραγκιαδάκη (Clemson University)

Fractional Sobolev Embeddings and Algebra Property: A Dyadic View

In this talk, we revisit classical fractional Sobolev embedding theorems and the algebra property of the fractional Sobolev space, $H^s(\mathbb{R})$, from a dyadic point of view. Inspired by previous work due to Aimar et al. we use Haar functions and dyadic decompositions to obtain the dyadic analogues of these classic results. Especially, in low regularities we provide explicit examples for the failure of the algebra property without using the Fourier transform.

Μαριάννα Χατζάκου (Ghent University)

On a class of anharmonic oscillators

We will discuss a class of anharmonic oscillators on $\mathbb{R}^n$ corresponding to Hamiltonians of the form $A(D) + V(x)$, where $A(\xi)$ and $V(x)$ are smooth functions satisfying some regularity conditions. Our analysis is in the framework of Weyl-Hörmander classes of operators. The relation of the latter with the Schatten-von Neumann classes of operators will be used to derive spectral properties of these operators. The talk will be based on the joint works *Chatzakou, M., Delgado, J., and Ruzhansky, M. (2021) "On a class of anharmonic oscillators", J. Math. Pures Appl.* and *Chatzakou, M., Delgado, J., and Ruzhansky, M. (2022) "On a class of anharmonic oscillators: General case", Bull. Math. Sci.*

Γεώργιος Ψαρομήλιγκος (Πανεπιστήμιο Θεσσαλίας)

Configurations in Distance Problems: Restricted Diagonals, Box Distances, and Falconer

The Falconer distance problem lies at the interface of harmonic analysis, geometric measure theory, and additive combinatorics. It asks how large the Hausdorff dimension of a compact set $E \subset \mathbb{R}^d$ must be to ensure that its distance set

$$\Delta(E) = \{|x - y| : x, y \in E\}$$

has positive Lebesgue measure. Despite remarkable progress—from Bourgain and Wolff in the plane to Erdoğan and the recent Guth–Iosevich–Ou–Wang and Du–Iosevich–Ou–Wang–Zhang results in higher dimensions—the conjectured threshold $\dim_H(E) > d/2$ remains open.

In this talk, I will give a survey from the original Falconer problem to the most recent results as well as describing new problems, inspired by Falconer's framework, but focused on multi-point configurations. The first, due to *Gaitan–Greenleaf–Palsson–Psaromiligkos* (CJM 2025), establishes interior results for restricted (diagonal) configuration distance sets at the threshold $(2d+1)/3$, using bilinear spherical averages and a multilinear Fourier integral operator framework stable under analytic perturbations of the metric. The second, by *Borges–Iosevich–Ou* (2023), treats a singular box-distance variant and proves positive-measure and pinned-interval results at the level $d/2 + 1/4$ through a sum-set reduction linked directly to the pinned Falconer problem. The latter work improves the first on certain occasions but there is room for improvement for the various problems found in these works.

Although these results arise in different settings, they form complementary steps within the same analytical narrative: both employ the harmonic-analytic machinery of the Falconer program—spherical averages, bilinear estimates, and microlocal stability—to control richer configuration maps. I will outline how these methods illuminate each other within fractal geometry, showing how they sharpen dimension thresholds for distance and simplex configuration problems and how they point toward a unified, configuration-based approach to distance phenomena in fractal sets.