Around harmonic analysis: applications to number theory, geometric measure theory, PDE, and more
Analyse harmonique: applications à la théorie des nombres, la théorie géometrique de la mesure, les EDP et plus
(Org: **Suresh Eswarathasan** (Dalhousie University) and/et **Chamsol Park** (University of Rochester))

DMITRY JAKOBSON, McGill

Nodal sets, negative eigenvalues and curvature prescription

We discuss conformal invariants arising fromspectra and eigenfunctions of conformally covariant differential operators, with applications to curvature prescription problems, as well as to the study of geometry of spaces of conformal structures.

KAINING JIA, UBC

DIMITRIS KOKOULOPOULOS, University of Montréal

JUYOUNG LEE, University of British Columbia

The Fourier restriction problem for biradial functions

We determine the exact strong-type Fourier restriction range for the unit sphere $\mathbb{S}^{d-1}$ on the class of $O(d-k)\times O(k)$-invariant functions, for every $d \geq 4$ and $2 \leq k \leq d-2$. This includes the critical estimates beyond the biradial Stein–Tomas endpoint left open by Mandel and Oliveira e Silva. This is a joint work with Kinoshita, Oliveira e Silva, and Shiraki.

CALEB MARSHALL, University of Toronto

EMILY QUESADA-HERRERA, University of Lethbridge

JOHN TOTH, McGill

Non-concentration estimates for Laplace eigenfunctions on compact C^∞ manifolds with boundary

Let Ω be an n-dimensional compact Riemannian manifold with C^∞ boundary, and consider L^2-normalized eigenfunctions $-\Delta\phi_\lambda = \lambda^2\phi_\lambda$ with Dirichlet or Neumann boundary conditions. In this talk, I will describe reccent joint work with H. Christianson (UNC) on the extension of interior nonconcentration bounds up to the boundary. Specifically, using purely stationary local methods, we prove that for such Ω it follows that for *any* $x_0 \in \overline{\Omega}$ (including boundary points) and for all $\mu \geq C_\Omega h$ with sufficiently large constant $C_\Omega > 0$,

$$\|\phi_\lambda\|^2_{B(x_0,\mu)\cap\Omega} = O(\mu). \tag{1}$$

We also extend a result of C. Sogge to manifolds with smooth boundary and show that when $n \geq 3$,

$$\|\phi_\lambda\|_{L^\infty(\Omega)} \leq C\lambda^{\frac{n}{2}} \cdot \Big(\sup_{x\in\Omega} \|\phi_\lambda\|_{L^2(B(x,\lambda^{-1})\cap\Omega)}\Big). \tag{2}$$

The sharp sup bounds $\|\phi_\lambda\|_{L^\infty(\Omega)} = O(\lambda^{\frac{n-1}{2}})$ for Dirichlet or Neumann eigenfunctions proved by D. Grieser are then an immediate consequence of these bounds.

AMIR VIG, University of Toronto

ALEXIA YAVICOLI, The University of British Columbia
The Erdős Similarity Conjecture and Rajchman measures

The Erdős similarity conjecture asserts that every infinite subset of the real line can be avoided by a measurable set of positive measure: the latter contains no translated and rescaled copy of the former. In this talk, I will prove the conjecture for sets supporting a Rajchman probability measure—that is, a probability measure whose Fourier transform tends to zero at infinity. More precisely, for any such set A and any $\varepsilon > 0$, we construct a closed, 1-periodic, nowhere dense set containing no affine copy of A, yet having measure at least $1 - \varepsilon$ in every interval of length 1.

This talk is based on a joint work with Natalia Mora Cuellar, Alex Iosevich, Neeraja Kulkarni and Ignacio Rojas Aravena.

Arxiv link: https://arxiv.org/abs/2609.04456

ZHICHUN ZHAI, MacEwan University
On Equivalent and Strengthened Affine Fractional Sobolev Inequalities

Affine fractional Sobolev inequalities provide refinements of classical fractional Sobolev inequalities by incorporating affine geometric structures. We establish several equivalent formulations of these inequalities. In particular, we show that affine fractional Sobolev inequalities, up to multiplicative constants, are equivalent to affine fractional Lorentz, Hardy, and isocapacitary inequalities.

We introduce affine fractional capacities and establish their fundamental properties, including capacitary strong-type inequalities. Using these capacities, we further strengthen the affine fractional Sobolev inequalities through embeddings into capacitary Lorentz spaces. As applications, we derive affine fractional Gagliardo–Nirenberg inequalities and affine fractional logarithmic Sobolev inequalities.

Our results highlight the interplay between harmonic analysis, affine geometry, fractional nonlocal regularity, and capacity theory, providing new perspectives on the refinement and equivalence of functional inequalities.