1 Titles and Abstracts

1. Michael Lacey

   Title: The Wiener Wintner Theorem for Prime Averages

   Abstarct: The classical Wiener Wintner Theorem has an extension to prime averages. Namely, for all measure preserving system (X, m, T), and bounded function f on X, there is a set of full measure $X_f \subset X$ so that for all $x \in X_f$, the averages below

   $$\frac{1}{N}\sum_{n=1}^{N} \phi(n)\Lambda(n)f(T^n x)$$

   converge for all continuous 2π periodic ϕ. Above, Λ is the von Mangoldt function. The proof uses the structure theory of measure preserving systems, the Prime Ergodic Theorem, and higher order Fourier properties of the Heath-Brown approximate to the von Mangoldt function. Joint work with J. Fordal, A. Fragkos, Ben Krause, Hamed Mousavi, and Yuchen Sun.

2. Anastasios Fragkos

   Title :Title: Fractionally modulated discrete Carleson's Theorem and pointwise Ergodic Theorems along certain curves. Abstract: For $c \in (1, 2)$, we consider the following operators:

   $$C_c f(x) := \sup_{\lambda \in [-1/2, 1/2)} \left| \sum_{n \neq 0} \frac{f(x-n)}{n} e^{2\pi i \lambda \lfloor |n|^c \rfloor} \right|$$

   $$C_c^{\mathrm{sgn}} f(x) := \sup_{\lambda \in [-1/2, 1/2)} \left| \sum_{n \neq 0} \frac{f(x-n)}{n} e^{2\pi i \lambda \,\mathrm{sign}(n) \lfloor |n|^c \rfloor} \right|.$$

   We prove that both operators extend boundedly on $\ell^p(\mathbb{Z})$, for $p \in (1, \infty)$. The second main result is establishing almost everywhere pointwise convergence for the following ergodic averages:

   $$A_N f(x) := \frac{1}{N}\sum_{n=1}^{N} f(T^n S^{\lfloor n^c \rfloor} x),$$

   where $T, S : X \to X$ are commuting measure-preserving transformations on a σ-finite measure space (X, μ), and $f \in L^p_\mu(X)$, $p \in (1, \infty)$. The point of departure for both proofs is the study of exponential sums with phases $\xi_2 \lfloor |n|^c \rfloor + \xi_1 n$ through the use of a simple variant of the circle method.

3. Bingyang Hu

   Title: On the maximally modulated bilinear Hilbert transform along curves: a quick dive into the LGC methodology

   Abstract: We study L^p bounds for a bilinear Hilbert–Carleson operator along the moment curve (t, t^2, t^3). Using the Rank II Linearization–Gabor–Cancellation (LGC) methodology in time–frequency analysis, we obtain the optimal mapping

   $$T : L^{p_1} \times L^{p_2} \to L^r, \qquad 1 < p_1 < p_2 < \infty,\ 1/2 < r < \infty.$$

   For comparison, we also give a short proof of the L^p bounds for the bilinear Hilbert transform along (t, t^2) via the Rank I LGC framework, and we discuss the similarities and differences between the two approaches. The talk is based on recent joint work with Árpád Bényi and Victor Lie.

4. Alexander Ortiz

   Title: Tangency counting for well-spaced circles

   Abstract: In the late 1990s, Wolff introduced the circle tangency problem: among N circles, no three tangent at a point, how many pairs can be internally tangent? He proved an $O(N^{(3/2+\epsilon)})$ bound, later refined to $O(N^{3/2})$ by Ellenberg, Solymosi, and Zahl -a barrier that has held for over twenty-five years. The conjectured sharp bound $O(N^{(4/3+\epsilon)})$ is achieved by grid-like configurations. In recent joint work with Dominique Maldague, we show that for well-spaced families, which resemble these conjectural extremizers, this $N^{3/2}$ barrier can be broken, with an upper bound of $O(N^{(25/18+\epsilon)})$. I will describe the background and our approach using ideas from Fourier restriction theory for the truncated cone in $\mathbb{R}^3$.

5. Irina Holmes

   Title: Geometry of Sharpness: Sparse Operators Through the Bellman Lens

   Abstract: I will discuss recent developments in the Bellman function approach to sparse operators. We work in the dyadic setting, where sparse operators have become a standard tool in the last few years - largely due to the sharp results one obtains from strong-type bounds. Several open problems involve weak-type bounds, which are much more difficult to sharpen. We explore this aspect through the Bellman function method, which turns out to have a very interesting behavior when applied to sparse operators, revealing the underlying geometry governing optimality, and turning sharpness into shape. This is ongoing work with Guillermo Rey, Kristina Skreb, and Jack Small.

6. Chian Yeong Chua

   Title: A Bourgain–Gromov problem on Non–Compact Sobolev and Besov Embeddings

   Abstract: In this talk we will introduce certain weak compactness conditions for bounded linear maps, called strictly and finitely strictly singular. We give a classification of all non–compact embedding between Besov spaces, both on bounded domains and on $\mathbb{R}^n$, that are finitely strictly singular or strictly singular. As a direct application, we give a simple proof that the Sobolev–Lorentz embedding

$$W_0^{1,p}(\Omega) \mapsto L^{p^*,q}(\Omega)$$

   where $p < q \leqslant \infty$

   is finitely strictly singular, which simplifies the previous work by Lang–Mihula.

7. Xiaoqi Huang

   Title: Strichartz estimates on asymptotically hyperbolic surfaces with negative curvature.

   Abstract: We discuss lossless Strichartz estimates on asymptotically hyperbolic surfaces, with convex cocompact hyperbolic surfaces as a primary example. A key ingredient in our approach is a log-scale lossless Strichartz estimate, which relies on local harmonic analysis arguments and holds on general complete manifold with bounded geometry. By adapting the arguments of Burq, Guillarmou, and Hassell, we employ this log-scale estimate alongside known L2-local smoothing estimates due to Bourgain-Dyatlov to obtain the desired results.

8. Simon Bortz

   Title: Parabolic Uniform Rectifiability and L^p Dirichlet Solvability for the Heat Equation

   Abstract: I will discuss recent joint work with S. Hofmann, J.M. Martell, and K. Nyström in which we show that, under mild geometric and analytic hypotheses, L^p-solvability of the parabolic Dirichlet problem in a (time-dependent) domain implies that the boundary of the domain is uniformly (i.e. quantitatively) rectifiable in the parabolic sense.

9. Yaghoub Rahimi

   Title: A Density Theorem for Higher Order Sums of Prime Numbers

   Abstract: Let P be a subset of the primes of lower density strictly larger than 1/2. Then, every sufficiently large even integer is a sum of four primes from the set P. We establish similar results for k-summands, with $k \geqslant 4$, and for $k \geqslant 4$ distinct subsets of primes. This extends the work of H. Li, H. Pan, as well as X. Shao on sums of three primes, and A. Alsteri and X. Shao on sums of two primes. The primary new contributions come from elementary combinatorial lemmas.

10. Vishwa Dewage

Title: Understanding Toeplitz operators from a QHA perspective.

Abstract: Quantum harmonic analysis (QHA) was introduced by Werner in 1984 for the abelian setting of phase space and has since evolved into a flourishing area of mathematics. In QHA, we develop notions in classical harmonic analysis, such as convolutions and Fourier transforms for operators instead of functions. This framework aligns quite well with the analysis of Toeplitz operators on the Fock space (and also certain Bergman spaces), leading to an intuitive and effective approach to many problems. We discuss a few recent developments in the theory of Toeplitz operators, obtained via QHA.

11. Hongki Jung

Title: Maximal $\Lambda(p)$–subsets of manifolds

Abstract: In 1989, Bourgain proved the existence of maximal $\Lambda(p)$–subsets within the collection of mutual orthogonal functions. We shall explore the Euclidean analogue of $\Lambda(p)$—sets through localization. As a result, we construct maximal $\Lambda(p)$–subsets on a large class of curved manifolds, in an optimal range of Lebesgue exponents p. This is joint work with C. Demeter and D. Ryou.

12. Wojciech Slomian

Title: Bootstrap Approach to Discrete Radon Averages

Abstract: The *bootstrap method* for proving an inequality consists in estimating the left-hand side of the inequality, say L, by an expression of the form

$$L \leqslant C\,L^{\theta},$$

where $C > 0$ is independent of L and $\theta \in [0, 1)$. Dividing both sides by L^{θ} yields $L^{1-\theta} \leqslant C$, and since $1 - \theta > 0$, we obtain the nontrivial bound

$$L \leqslant C^{1/(1-\theta)}.$$

The term "bootstrap" reflects that the argument relies only on L itself to derive its own upper bound.

In this talk we present a new bootstrapping proof of the *Bourgain maximal inequality* for the discrete Radon averages

$$\mathcal{M}_N^P f(x) := \frac{1}{2N+1} \sum_{|y| \leqslant N} f(x - P(y)),$$

where P is a polynomial with integer coefficients.

13. Nathan Mehlhop

Title: Multiparameter Oscillation Inequalities

Abstract: We prove strong Lp and weak type (1,1) oscillation inequalities, which are stronger than maximal function estimates, for certain multiparameter averaging operators taken over orbits of polynomials in several variables. Oscillation inequalities are of particular interest for their role in pointwise convergence problems. A key technique in obtaining these inequalities is a decomposition of the parameter space based on Newton diagrams. This allows one to extract dominating monomials and bound estimates for the error terms.