# International Conference on Harmonic Analysis and Applications

City University of New York
The Graduate Center, Department of Mathematics
New York

June 1-5, 2015

Organizers:
Alex Iosevich, Rochester University
Azita Mayeli, Queensborough CC. & The Graduate Center, CUNY
Gestur Ólafsson, Louisiana State University

Student Organizer:
Max Yarmolinsky, The Graduate Center, CUNY

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**Monday June 1, 2015**
**Science Center, Room 4102**

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| 9:15-10 am | Registration and coffee |
| 10-10:45 am | Elias Stein, Princeton University<br>*The Cauchy-Szego projection in several complex variables* |
| 11-11:45 am | Shahaf Nitzan, Kent State University<br>*Exponential Frames on Unbounded Sets* |
| 12-2 pm | Lunch break |
| 2-2:45 pm | Jill Pipher, Brown University and ICERM<br>*Carleson measures and elliptic and parabolic boundary value problems* |
| 3- 3:15 pm | Coffee break |
| 3:15-4 pm | Ignacio Uriarte-tuero, Michigan State University<br>*Two weight norm inequalities for singular and fractional integral operators in* $\mathbb{R}^n : T1$ *theorems* |
| 4:15- 5 pm | Eyvindur A. Palsson, Williams College<br>*Finite point configurations* |

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**Tuesday June 2, 2015**
**Science Center, Room 4102**

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|---|---|
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| 10- 10:45 am | Peter G. Casazza, University of Missouri<br>*Phase Retrieval* |
| 11-11:45 am | Radu Balan, University of Maryland, College Park<br>*Phase Retrieval using Lipschitz Continuous Maps* |
| 12-2 pm | Lunch break |
| 2-2:45 pm | Mauro Maggioni, Duke University<br>*Multiscale Geometric Methods for Statistical Learning and Data in High-Dimensions* |
| 3-3:15 pm | Coffee break |
| 3:15-4 pm | Alex Powell, Vanderbilt University<br>*Consistent reconstruction and randomized recovery algorithms* |
| 4:15- 4:35 pm | Scott Spencer, Georgia Institute of Technology<br>*Entropy Bumps for Calderón-Zygmund Operators* |
| 4:45-5:05 pm | Richard Lynch, University of Missouri<br>*Weaving Frames* |

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**Wednesday June 3, 2015**
**Science Center, Room 4102**

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|---|---|
| 9:15-10 am | Registration and coffee |
| 10-10:45 am | John J. Benedetto, University of Maryland, College Park<br>*Frames from signal processing and back again - a sampling* |
| 11-11:45 am | Isaac Pesenson, Temple University<br>*Parseval Localized Frames for Subelliptic Function Spaces on Compact Manifolds* |
| 12-2 pm | Lunch break |
| 2-2:45 pm | Adam Koranyi, Lehman College, & the Graduate Center, CUNY<br>*Holomorphically induced representations of* $SU(2,1)$ |
| 3-3:15 pm | Coffee break |
| 3:15-4 pm | Sigurdur Helgason, MIT<br>*Spherical Functions and Radon Transforms* |
| 4:15-5 pm | Jens Christensen, Colgate University<br>*New Atomic Decompositions of Bergman Spaces* |
| | Banquet |

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**Thursday June 4, 2015**
**Science Center, Room 4102**

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|---|---|
| 9:15-10 am | Registration and coffee |
| 10-10:45 am | Thao Nguyen, City College, CUNY<br>*Finite-power sequences: misconceptions, facts, and their role in the spectral analysis of sigma-delta quantization* |
| 11-11:45 am | Akram Aldroubi, Vanderbilt University<br>*Dynamical Sampling, cyclical sets, cyclical frames sets and the spectral theory* |
| 12- 2 pm | Lunch break |
| 2-2:45 pm | Bradley Currey, St. Louis University<br>*Detecting admissible dilation groups* |
| 3-3:15 pm | Coffee break |
| 3:15 -4 pm | C. Sinan Güntürk, Courant Institute, NYU<br>*Beta duals of frames and near-optimal quantization* |
| 4:15- 4:35 pm | Farras Abdelnour, Weill Cornell Medical College<br>*Predicting brain's functional network from structure's Laplacian* |
| 4:45-5:05 pm | Jacqueline Davis, Arizona State University<br>*Fast Imaging Techniques using Fourier Frames* |
| 5:10- 6 pm | Problem session |

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**Friday June 5, 2015**
**Room 5417 (Notice the room change)**

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|---|---|
| 9:15-10 am | Registration and coffee |
| 10-10:45 am | Ronald Coifman, Yale University<br>TBA |
| 11-11:45 am | Laura De Carli, Florida international university<br>*From Exponential Bases to the Discrete Hilbert Transform* |
| 12-2 pm | Lunch break |
| 2-2:45 pm | Judith A. Packer, University of Colorado at Boulder<br>*Wavelets associated to representations of graph* $C^*$ *-algebras* |
| 3- 3:15 pm | Coffee break |
| 3:15-4 pm | Eugenio Hernández, Universidad Autónoma de Madrid<br>*Frame sequences and operator valued bracket maps* |
| 4:15-4:35 pm | Matt Dawson, CIMAT<br>*Commuting Toeplitz Operators and Holomorphic Discrete Series Representation* |

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**Predicting brain's functional network from structure's Laplacian**

Farras Abdelnour faa2016@med.cornell.edu
*Weill Cornell Medical College*

The relationship between anatomic connectivity of large-scale brain networks and their functional connectivity is of immense importance and an area of ongoing research. Previous attempts have required complex simulations which model the dynamics of each cortical region, and explore the coupling between regions as derived by anatomic connections. While much insight is gained from these non-linear simulations, they can be computationally taxing tools for predicting functional from anatomic connectivities. We show that a simple linear model based on the Laplacian of the structural network adjacency matrix can predict the brain's functional network.

**Dynamical Sampling, cyclical sets, cyclical frames sets and the spectral theory**

Akram Aldroubi akram.aldroubi@vanderbilt.edu
*Vanderbilt University*

Let $f$ be a signal at time $t = 0$ of a dynamical process controlled by an operator $A$ that produces the signals $f, Af, A^2f, \dots$ at times $t = 1, 2, \dots$. Let $M$ be a measurements operator applied to the series $f, Af, A^2f, \dots$ at times $t = 1, 2, \dots$. The problem is to recover $f$ from the measurements $Y = \{Mf, MAf, MA^2f, \dots, MA^Lf\}$. This is the so called Dynamical Sampling Problem. The problem is to find conditions on $A$, $X$, $M$, that are sufficient for the recovery of $f$. This problem has connection to many areas of mathematics including frames, and Banach algebras, and the recently solved Kadison-Singer/Feichtinger Theorm. We will discuss the problem, its applications, and some recent results.

**Phase Retrieval using Lipschitz Continuous Maps**

Radu Balan rvbalan@math.umd.edu
*Norbert Wiener Center, University of Maryland, College Park*

In this talk we show that reconstruction from magnitudes of frame coefficients (the so called "phase retrieval problem") can be performed using

Lipschitz continuous maps. Specifically we show that when the nonlinear analysis map $\alpha : H \to R^m$ is injective, with $(\alpha(x))_k = |\langle x, f_k \rangle|$, where $\{f_1, ..., f_m\}$ is a frame for the Hilbert space $H$, then it is bi-Lipschitz on $\hat{H}$ endowed with the natural metric $D_2(x, y) = \min_\varphi \|x - e^{i\varphi} y\|_2$ and it admits a Lipschitz inverse. The same result holds for the square map $x \mapsto (|\langle x, f_k \rangle|^2)_k$. We obtain the Lipschitz constants of the inverse maps. We show the extension from the range of nonlinear maps to the entire space of coefficients $R^m$ increases the Lipschitz constants by a small constant factor. This is a joint work with Dongmian Zou.

**Frames from signal processing and back again - a sampling**

John J. Benedetto `jjb@math.umd.edu`
*Norbert Wiener Center, University of Maryland, College Park*

With the common theme and technology of the theory of frames, we present the following:

a. a best possible ambiguity function theorem using Weil's theorem on the Riemann hypothesis for finite fields, with applications to waveform design for radar;

b. a theory of vector valued ambiguity functions using representation theory, with applications to multi-sensor environments and MIMO;

c. graph theoretic uncertainty principle inequalities, with applications dealing with non-linear spectral methods for dimension reduction and classification;

d. short time Fourier transform inequalities using balayage and spectral synthesis, with applications to non-uniform sampling and super-resolution imaging.

The first part is a collaboration with Robert Benedetto and Joseph Woodworth; the second part is a collaboration with Jeffrey Donatelli and Travis Andrews; the third part is a collaboration with Paul Koprowski; and the fourth part is a collaboration with Enrico Au-Yeung.

**Phase Retrieval**

Peter Casazza casazzap@missouri.edu
*University of Missouri*

Over the 100 year history of phase retrieval, it has had broad application to x-ray crystallography, electron microscopy, diffractive imaging, DNA, x-ray tomography and much more. Phase retrieval will even be needed to align the mirrors of the new James Webb Space Telescope scheduled for launch in 2018. We will start with the fundamentals of phase retrieval and its applications which have garnered a dozen Nobel Prizes over the years. Only recently have mathematicians entered this area to give a solid mathematical foundation to phase retrieval. In the second half of this talk we will look at recent advances in the mathematics of phase retrieval.

**New Atomic Decompositions of Bergman Spaces**

Jens Christensen jchristensen@colgate.edu
*Colgate University*

We present new atomic decompositions for Bergman spaces on the unit ball in the spirit of Coifman, Rochberg and Luecking. Our approach uses discrete series representations of the simple group $SU(n,1)$, and we obtain a much larger class of admissible atoms compared to previous results. In the process we will mention how the continuity of Forelli-Rudin type operators on the unit ball is related to the amenability of a certain solvable subgroup of $SU(n,1)$, as well as to the celebrated Kunze-Stein phenomenon for semisimple Lie groups. This talk is based on joint work with Karlheinz Gröchenig and Gestur Ólafsson.

**Detecting admissible dilation groups**

Brad Currey curreybn@slu.edu
*Saint Louis University*

Let $H$ be a closed connected subgroup of $GL(d,\mathbb{R})$. For $h \in H$ and $\psi \in L^2(\mathbb{R}^d)$ define $D_h\psi = \psi(h^{-1}\cdot)|\det h|^{-1/2}$. $H$ is said to be admissible if there is $\psi \in L^2(\mathbb{R}^d)$ such that the map

$$V_\psi : \phi \mapsto \langle \phi, T_x D_h \psi \rangle$$

is a well-defined isometry of $L^2(\mathbb{R}^d)$ into $L^2(G)$ where $G = \mathbb{R}^d \rtimes H$. In this case, convolution by the element $V_\psi \psi$ projects $L^2(G)$ onto the image $\mathcal{H}$ of $V_\psi$. $H$ is integrably admissible if there is $\psi$ for which $\Delta^{-1/2} V_\psi \psi$ is an idempotent in the Banach $*$-algebra $L^1(G)$, and irreducibly admissible if $\mathcal{H}$ is irreducible for the action of left translation in $L^2(G)$. Whether or not a dilation group $H$ is admissible, integrably admissible, or irreducibly admissible is closely related to certain characteristics of the space $\mathbb{R}^d/H^T$ of orbits under the transpose action of $H$. When $H = \{e^{tA} : t \in \mathbb{R}\}$, these characteristics are clearly reflected in the generator $A$. When $H$ is multiply-generated, characterizations become more problematic. If $H$ is irreducibly admissible, then the coorbit theory of Feichtinger and Gröchenig obtains atomic decomposition for the weighted space $L^2(\mathbb{R}^d)_w$ of analyzable vectors, where $w = \Delta^{-1/2}$. Aspects of coorbit theory go through in the case where $H$ is integrably but not irreducibly admissible. In this talk, methods are presented by which certain families of admissible, multiply-generated dilation groups are detected and described. These results reflect joint work with D. Arnal, H. Führ, V. Oussa, and K. Taylor.

**Fast Imaging Techniques using Fourier Frames**

Jacqueline Davis `jtdavi14@asu.edu`
*Arizona State University*

In applications such as magnetic resonance imaging (MRI) and synthetic aperture radar (SAR), data are given as non-uniform Fourier samples. Therefore the standard inverse Fourier transform cannot be applied directly to recover the underlying image. We show that by considering the data as Fourier frame coefficients, the image can be reconstructed in FFT time. By extending this perspective further, we demonstrate that it is possible to accurately and efficiently detect edges from the non-uniform Fourier samples directly, without first reconstructing the underlying image.

**Commuting Toeplitz Operators and Holomorphic Discrete Series Representations**

Matthew Dawson matthew.dawson@cimat.mx
*Centro de Investigación en Matemáticas, A.C.*

Toeplitz operators provide a well-studied example of quantization in the context of weighted Bergman spaces on bounded symmetric domains. One of the traditional problems in Toeplitz-operator theory is to construct and classify commutative $C^*$ algebras generated by Toeplitz operators. We produce several new examples of such algebras and move closer to a classification of them by using some results on multiplicity-free restrictions of the holomorphic discrete series. Joint work with Gestur Ólafsson (LSU) and Raúl Quiroga (CIMAT).

**From Exponential Bases to the Discrete Hilbert Transform**

Laura De Carli decarlil@fiu.edu
*Florida International University*

The discrete Hilbert transform was first studied by D. Hilbert and H. Weil in 1908 and has generated interest among the mathematician ever since. In this talk I will show how a seemingly simple problem on exponential bases on $L^2$ lead to the investigation of a one-parameter semigroup of operators on $l^2$ whose infinitesimal generator is the discrete Hilbert transform. If time allows, I will also present other families of discrete operator that appear in connection with problems on exponential bases. Part of this work-in-progress is joint with my student Shaikh Gohin Samar.

**Beta duals of frames and near-optimal quantization**

C. Sinan Güntürk gunturk@cims.nyu.edu
*Courant Institute of Mathematical Sciences, NYU*

This talk will be about a renewed theory of noise-shaping quantization and how it has led to the design of near-optimal algorithmic solutions to a variety of quantization problems in signal processing. Of particular interest will be beta duals of frames.

**Spherical Functions and Radon Transforms**

Sigurdur Helgason `helgason@mit.edu`
*Massachusetts Institute of Technology*

The analogy between analysis on a symmetric space $G/K$ and its tangent space $G_o/K$ leads to some unsettled questions concerning the spherical functions for both spaces. These functions are related to the Radon transform on $G/K$ and to the maximal ideal varieties for the spaces of $K$ bi invariant functions on both sides.

**Frame sequences and operator valued bracket maps**

Eugenio Hernández `eugenio.hernandez@uam.es`
*Universidad Autónoma de Madrid*

We characterize Riesz and frame sequences which arise from the action of a countable discrete group $\Gamma$ on a single element of a given Hilbert space $H$. As $\Gamma$ might not be abelian, this is done in terms of an operator-valued bracket map taking values in the $L^1$-space associated to the group von Neumann algebra of $\Gamma$. Our result generalizes work done for locally compact abelian groups by Hernández, Šikić, Weiss and Wilson. In many cases, the bracket map can be decribed in terms of a noncommutative form of the Zak transform.

**Holomorphically induced representations of** $SU(2,1)$

Adam Koranyi
*Lehman College, & the Graduate Center, CUNY*

Let $g$ be a simple Lie algebra of Hermitian type, $g = k + p$ its Cartan decomposition, $G$ a corresponding group, $D$ the associated bounded symmetric domain. The complexification $g^C$ has a parabolic subalgebra containing $k$, usually denoted $k^C + p-$. We study the unitary representations of $G$ gotten by holomorphic induction from finite dimensional representations $R$ of $k^C + p-$. When $R$ is zero on $p-$, these give the well known holomorphic discrete series of Harish-Chandra. For general $R$, by general principles one gets a representation equivalent to a direct sum of Harish-Chandra's repre-

sentations. Here, for the case of $SU(2,1)$, but conjecturally quite in general, we realize this equivalence by a certain differential operator. This result also leads to the answer to a question in operator theory, which was the original motivation for this work. The results are joint with G. Misra.

**Weaving Frames**

Richard Lynch `rglz82@mail.missouri.edu`
*University of Missouri*

We introduce a new area of study called *Weaving Frames*, which has potential applications in distributed data processing and preprocessing of signals using Gabor frames. Two frames $\{\phi_i\}_{i\in I}$ and $\{\psi_i\}_{i\in I}$ for a Hilbert space $\mathbb{H}$ are *woven* if there are constants $0 < A \leq B$ so that for every subset $\sigma \subset I$, the family $\{\phi_i\}_{i\in\sigma} \cup \{\psi_i\}_{i\in\sigma^c}$ is a frame for $\mathbb{H}$ with frame bounds $A, B$. Fundamental properties of woven frames are developed and key differences between weaving Riesz bases and weaving frames are considered. We also introduce an apparently weaker form of *weaving* but show that it is equivalent.

**Multiscale Geometric Methods for Statistical Learning and Data in High-Dimensions**

Mauro Maggioni `mauro.maggioni@duke.edu`
*Duke University*

We discuss a family of ideas, algorithms, and results for analyzing various new and classical problems in the analysis of high-dimensional data sets. These methods rely on the idea of performing suitable multiscale geometric decompositions of the data, and exploiting such a decomposition to perform a variety of tasks in signal processing and statistical learning. In particular, we discuss the problem of dictionary learning, where one is interested in constructing, given a training set of signals, a set of vectors (dictionary) such that the signals admit a sparse representation in terms of the dictionary vectors. We discuss a multiscale geometric construction of such dictionaries, its computational cost and online versions, and finite sample guarantees on its quality. We then generalize part of this construction to other tasks, such as learning an estimator for the probability measure generating the data, again with fast algorithms with finite sample guarantees, and for learning certain types of stochastic dynamical system in high-dimensions. Applications to construction of multi-resolution dictionaries for images, with the incorporation of invariances, will be discussed.

**Finite-power sequences: misconceptions, facts, and their role in the spectral analysis of sigma-delta quantization**

Thao Nguyen `thao@ee.ccny.cuny.edu`
*City College of New York, CUNY*

Although originally defined in a deterministic sense like finite-energy signals, the culture of finite-power signals has drifted towards pure stochastic analysis for some historical reason. It appears as a result that the functional setting for their deterministic spectral analysis has remained somewhat unresolved. As a matter of fact, the full space of finite-power signals is not linear, preventing any Hilbert space structure in its entirety. The popular belief that these signals form a Hilbert space similar to that of finite-energy signals is perhaps linked to their assimilation with almost-periodic signals. However, these signals can only produce discrete spectra, and hence are incapable of describing phenomena such as white noise.

In this work, we build some Hilbert space foundations for the spectral analysis of finite-power sequences that do yield continuous spectra and appear in particular in sigma-delta quantization. The considered space of sequences is more specifically spanned by complex exponentials of real polynomials of time. Although this forms a non-separable Hilbert space, spectral analysis remains relatively simple in principle thanks to the theory of equidistribution, and gives rise to high-order Fourier series expansions. The previous deterministic derivation of white noise in sigma-delta quantization by Robert Gray is easily retrieved in this setting, but non-white continuous noise spectra are found to be more typical of high-order sigma-delta modulators.

**Exponential Frames on Unbounded Sets**

Shahaf Nitzan `snitzan@kent.edu`
*Kent State University*

In contrast to orthonormal and Riesz bases, exponential frames (i.e., 'over complete bases') are in many cases easy to come by. In particular, it is not difficult to show that every bounded set of positive measure admits an exponential frame.

When unbounded sets (of finite measure) are considered, the problem becomes more delicate. In this talk I will discuss a joint work with A. Olevskii and A. Ulanovskii, where we prove that every such set admits an exponential frame. To obtain this result we apply one of the outcomes of Marcus, Spielman and Srivastava's recent solution of the Kadison-Singer conjecture.

**Wavelets associated to representations of graph $C^*$-algebras**
Judith Packer `judith.jesudason@Colorado.edu`
*University of Colorado at Boulder*

Let $\Lambda$ denote a finite $k$-graph in the sense of A. Kumjian and D. Pask that is strongly connected, and let $\Lambda^\infty$ denote its infinite path space. I discuss some recent joint work with C. Farsi, E. Gillaspy, and S. Kang, where we construct a system of functions that we call "wavelets" on a Hilbert space of square-integrable functions on $\Lambda^\infty$. In so doing, we generalize work of M. Marcolli and A. Paolucci for finite directed graphs to the higher rank case. The key tool is the construction of a representation of the graph $C^*$-algebra $C^*(\Lambda)$ on $L^2(\Lambda^\infty, M)$ for the appropriate measure $M$. When the finite $k$-graph $\Lambda$ in question is strongly connected and aperiodic, the representation of $C^*(\Lambda)$ that we obtain is faithful.

**Finite point configurations**
Eyvindur Ari Palsson `eap2@williams.edu`
*Williams College*

Finding and understanding patterns in data sets is of significant importance in many applications. One example of a simple pattern is the distance between data points, which can be thought of as a 2-point configuration. Two classic questions, the Erdos distinct distance problem, which asks about the least number of distinct distances determined by N points in the plane, and its continuous analog, the Falconer distance problem, explore that simple pattern. Questions similar to the Erdos distinct distance problem and the Falconer distance problem can also be posed for more complicated patterns such as triangles, which can be viewed as 3-point configurations. In this talk

I will present recent progress on Erdos and Falconer type problems for simplices. The main techniques used come from analysis and geometric measure theory.

**Parseval Localized Frames for Subelliptic Function Spaces on Compact Manifolds**

Isaac Pesenson `pesenson@temple.edu`
*Temple University*

We consider a compact homogeneous manifold $M = G/H$, where $G$ is a compact Lie group and $H$ is a closed subgroup. Let $Y_1, \cdots, Y_m, m \leq n = dimM$, be elements of the Lie algebra **g** of $G$ that algebraically generate entire **g**. Let $X_1, \cdots, X_m$ be the natural images of the vector fields $Y_1, \cdots, Y_m$ on the manifold $M$. We consider the so-called sub-elliptic Laplace operator $\mathcal{L} = X_1^2 + \cdots + X_m^2$ in the natural space $L_2(M)$ and introduce sub-elliptic Sobolev and Besov spaces associated with $\mathcal{L}$.

The main objective is to construct a frame $\{\phi_\nu\}_{\nu \in J}$ in $L_2(M)$ which has the following properties:

(1) it is Parseval, i.e.

$$||f||^2 = \sum_\nu |\langle f, \phi_\nu \rangle|^2, f \in L_2(M);$$

(2) each $\phi_\nu$ has strong localization on $M$;

(3) each $\phi_\nu$ is bandlimited in the sense of the spectral resolution of $\mathcal{L}$.

Such frame is used to describe relevant Sobolev and Besov sub-elliptic spaces in terms of coefficients $\{\langle f, \phi_\nu \rangle\}_{\nu \in J}$

**Carleson measures and elliptic and parabolic boundary value problems**

Jill Pipher `jill_pipher@brown.edu`
*Brown University and ICERM*

We discuss joint work with Kenig, Kirchhiem, and Toro on elliptic equations and with Dindos and Petermichl on parabolic equations.

**Consistent reconstruction and randomized recovery algorithms**

Alex Powell alexander.m.powell@Vanderbilt.Edu
*Vanderbilt University*

Consistent reconstruction is a method for estimating a signal from a collection of noisy linear measurements that are corrupted by uniform noise. This problem arises, for example, in analog-to-digital conversion under the uniform noise model for memoryless scalar quantization. We shall give an overview of consistent reconstruction and prove optimal mean squared error bounds for the quality of approximation. We shall also discuss an iterative alternative (due to Rangan and Goyal) to consistent reconstruction which is also able to achieve optimal mean squared error; this is closely related to the classical Kaczmarz algorithm and provides a simple example of the power of randomization in numerical algorithms.

**Entropy Bumps for Calderón-Zygmund Operators**

Scott Spencer spencer@math.gatech.edu
*Georgia Institute of Technology*

We study two weight inequalities in the recent innovative language of 'entropy' due to Treil-Volberg. The inequalities are given new, short, proofs, and extended to $L^p$, for $1 < p \neq 2 < \infty$. A result proved is as follows. Let $\varepsilon$ be a monotonic increasing function on $(1, \infty)$ which satisfy $\int_1^\infty \frac{dt}{\varepsilon(t)t} = 1$. Let $\sigma$ and $w$ be two weights on $\mathbb{R}^d$. If this supremum is finite, for a choice of $1 < p < \infty$,

$$\sup_{Q \text{ a cube}} \left[\frac{\sigma(Q)}{|Q|}\right]^{p-1} \frac{\int_Q M(\sigma \mathbf{1}_Q)}{\sigma(Q)} \cdot \frac{w(Q)}{|Q|} \left[\frac{\int_Q M(w \mathbf{1}_Q)}{w(Q)}\right]^{p-1} < \infty,$$

then any Calderón-Zygmund operator $T$ satisfies the bound $\|T_\sigma f\|_{L^p(w)} \lesssim \|f\|_{L^p(\sigma)}$.

**The Cauchy-Szego projection in several complex variables**

Elias Stein stein@math.princeton.edu
*Princeton University*

A classical theorem of M. Riesz states in effect that for the unit disc, the Cauchy-Szego projection is a bounded operator on $L^p$, for finite $p > 1$. In this talk I will explain the background and ideas needed to extend this result to domains in several complex variables, in the setting where minimal assumptions of smoothness of the boundary are required. The results described are joint work with Loredana Lanzani.

**Two weight norm inequalities for singular and fractional integral operators in $R^n$: T1 theorems**

Ignacio Uriarte-Tueroi ignacio@math.msu.edu
*Michigan State University*

I will report on recent advances on the topic, related to proofs of T1 type theorems in the two weight setting for Calderón-Zygmund singular and fractional integral operators, with side conditions, and related counterexamples. Joint work with Eric Sawyer and Chun-Yen Shen.

**List of Participants:**

1. Farras Abdelnour, Weill Cornell Medical College
2. Vinh Adams, University of Maryland, College Park
3. Akram Aldroubi, Vanderbilt university
4. Elsa Angelini, Columbia University
5. Radu Balan, University of Maryland, College Park
6. John J. Benedetto, University of Maryland, College Park
7. Tejal Bhamre, Princeton University
8. Mukta Bhandari, Chowan University
9. Tyler Bongers, Michigan State University
10. Jean-Luc Bouchot, RWTH Aachen, Germany
11. Peter G. Casazza, University of Missouri
12. Jens Christensen, Colgate University
13. Alexander Cloninger, Yale University
14. Ronald Coifman, Yale University
15. Bradley Currey, St. Louis University
16. Arthur Danielyan, University of South Florida
17. Jacqueline Davis, Arizona State University
18. Matt Dawson, CIMAT
19. Laura De Carli, Florida international university
20. Robert Donley, Queensborough CC., CUNY
21. Amineh Farzannia, Michigan State University

22. Jasun Gong, Fordham University
23. Eric Grinberg, University of Massachusetts Boston
24. C. Sinan Güntürk, Courant Institute of Mathematical Sciences, NYU
25. Wangpeng He, New York University
26. Eugenio Hernández, Universidad Autónoma de Madrid
27. Thang Huynh, Courant Institute of Mathematical Sciences, NYU
28. Alex Iosevich, Rochester University
29. Joey Iverson, University of Oregon
30. Halyun Jeong, Courant Institute of Mathematical Sciences, NYU
31. Adam Koranyi, Lehman College, & the Graduate Center, CUNY
32. Michael Kumaresan, the Graduate Center, CUNY
33. Ishwari Kunwar, Georgia Institute of Technology
34. Kil H. Kwon, KAIST
35. Wenjing Liao, Duke University
36. Ian Long, University of Colorado at Boulder
37. Peter Luthy, Washington University in St. Louis
38. Richard Lynch, University of Missouri
39. Mauro Maggioni, Duke University
40. John Marinelli, College of Staten Island, CUNY
41. Azita Mayeli, Queensborough C.C., & the Graduate Center, CUNY
42. Mel Nathanson, Lehman, & the Graduate Center, CUNY
43. Thao Nguyen, City College, CUNY
44. Shahaf Nitzan, Kent State University

45. Gestur Ólafsson, Louisiana State University
46. Olga Orlova, Tallinn University of Technology
47. Judith A. Packer, University of Colorado at Boulder
48. Eyvindur A. Palsson, Williams College
49. Ankit Parekh, New York University
50. Isaac Pesenson, Temple University
51. Götz Pfander, Jacobs University
52. Jill Pipher, Brown University and ICERM
53. Anirudha Poria, Indian Institute of Technology Guwahati
54. Alex Powell, Vanderbilt University
55. Bob Putz, CUNY
56. Daher Radouan, University Hassan II of Casablanca Morocco
57. Robert Rahm, Georgia Tech
58. Mehdi Rashidi-Kouchi, Islamic Azad University
59. Boris Rubin, Louisiana State University
60. Palina Salanevich, Jacobs University Bremen, Germany
61. Steven Senger, Missouri State University
62. Mads Sielemann Jakobsen, Technical University of Denmark
63. Timothy Scott Spencer, Georgia Tech
64. Elias Stein, Princeton University
65. Diana T. Stoeva, Acoustics Research Institute, Austria
66. Janet C Tremain, University of Missouri
67. Ignacio Uriarte-tuero, Michigan State University

68. Felix Voigtlaender, RWTH Aachen, Germany
69. Larry Wang, Kennesaw State University
70. Meiniel William, Institut Pasteur - Paris, France
71. Jieren Xu, Duke University
72. Max Yarmolinsky, the Graduate Center, CUNY
73. Lei Yin, New York University