

Canadian Abstract Harmonic Analysis Symposium (CAHAS) 2014

August 29–31, 2014

MEALS

Coffee Breaks: As per daily schedule, in the foyer of the TransCanada Pipeline Pavilion (TCPL) (*included in workshop*)

For meal options at the Banff Centre, there are food outlets on The Banff Centre campus such as Vistas Main Dining Room on the 4th floor of Sally Borden Building (breakfast: 7:00–9:30am; lunch: 11:30am–1:30pm; dinner: 5:30–7:30pm), Le Cafe (ground floor, Sally Borden Building) and the Maclab Bistro (Kinnear Centre). You will also find a good selection of restaurants in the town of Banff which is a 10–15 minute walk from Corbett Hall.

MEETING ROOMS

All lectures will be held in the lecture theater in the TransCanada Pipelines Pavilion (TCPL). An LCD projector, a laptop, a document camera, and blackboards are available for presentations.

SCHEDULE

Friday

- 16:00** Check-in begins (Front Desk—Professional Development Centre—open 24 hours).
19:30 Informal gathering in the 2nd floor lounge, Corbett Hall (beverages and a small assortment of snacks are available in the lounge on a cash honor system).

Saturday

- 7:00–9:00** Breakfast
9:00–9:40 Nico Spronk
9:50–10:30 Mahmood Alaghmandan
10:30–11:00 Coffee Break, TCPL
11:00–11:40 Nazanin Tahmasebi
11:50–12:30 Mahya Ghandehari
12:30–2:00 Lunch
2:00–2:40 Matthew Wiersma
2:40–3:10 Coffee Break, TCPL
3:10–3:50 Varvara Shepalska
4:00–4:40 Joseph Iverson
4:50–5:30 Matthew Mazowita
5:40–6:20 Ross Stokke
Dinner

Sunday

- 7:00–9:00** Breakfast
9:00–9:40 Matthias Neufang
9:50–10:30 Safoura Jafar-Zadeh
10:30–11:00 Coffee break, TCPL
11:00–11:40 Ya Shu Wang
11:50–12:30 Michael Lamoureux
Checkout by 12 noon

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ABSTRACTS

Speaker: **Mahmood Alaghmandan** (University of Waterloo)

Title: *Weighted discrete hypergroups and their application to locally compact groups*

Abstract: Weighted group algebras have been studied extensively in Abstract Harmonic Analysis where complete characterizations have been found for some important properties of weighted group algebras, namely amenability and Arens regularity. One of the generalizations of weighted group algebras, which is presented here, is the theory of weighted hypergroup algebras. In this talk, after introducing weighted hypergroups, we present some results on Arens regularity and isomorphism with operator algebras about them. We also examine our results on some specific classes of discrete weighted hypergroups constructed by conjugacy classes of FC groups and the dual space of compact groups.

This is a joint project with Ebrahim Samei.

Speaker: **Mahya Ghandehari** (University of Waterloo)

Title: *On projections in the group algebra of unimodular groups*

Abstract: Let G be a locally compact group, and $L^1(G)$ denote its group algebra. Self-adjoint idempotent elements of $L^1(G)$ are called *projections*. This talk concerns with the study of projections in $L^1(G)$ in the special case where G is unimodular. We show that L^1 -projections in the unimodular case have a rather special form, namely they belong to the Fourier algebra. We then study minimal projections in details, and investigate how the support of a projection relates to its representing form in the Fourier algebra. This talk is based on a joint work in progress with M. Alaghmandan, N. Spronk, and K. F. Taylor.

Speaker: **Joseph Iverson** (University of Oregon)

Title: *Translation invariance over an abelian subgroup*

Abstract: Let G be a second countable, locally compact group, and let $H \subset G$ be a closed abelian subgroup. In this talk, we use range functions to classify the closed subspaces of $L^2(G)$ invariant under left translations by H . Our solution uses two new tools, which we have invented for this purpose: (1) a measure on the quotient space $H \backslash G$ of right cosets that allows for a measure space isomorphism $G \cong H \times H \backslash G$, and (2) a kind of Zak transform $L^2(G) \rightarrow L^2(\hat{H}; L^2(H \backslash G))$ that intertwines left translation by H with modulation by $\hat{H} \cong H$. For the subgroup $\mathbb{Z}^d \subset \mathbb{R}^d$, the latter is precisely the classical Zak transform. When G is not abelian, it is something entirely new.

Speaker: **Safoura Jafar-Zadeh** (University of Manitoba)

Title: *Isometric isomorphisms on the annihilator of $C_0(G)$ in $LUC(G)^*$*

Abstract: For a locally compact group G , let $LUC(G)$ denote the space of left uniformly continuous functions and $C_0(G)^\perp$ denote the annihilator of $C_0(G)$ in $LUC(G)^*$. In this talk, I will show that if G is a locally compact group and H is a discrete group, then, whenever there exists a weak* continuous isometric isomorphism between $C_0(G)^\perp$ and $C_0(H)^\perp$, G is isomorphic to H as a topological group. Several related results will also be discussed.

Speaker: **Michael Lamoureux** (University of Calgary)

Title: *Time-frequency multipliers*

Abstract: The tools of harmonic analysis have their use in a variety of applications, including in the solution of partial differential equations and their use in imaging application. This talk presents the use of localized Fourier transforms, wavelet transforms, and other time-frequency methods in producing accurate images of the earth (in seismic imaging) or of the human body (in medical images). A time-frequency

multiplier is a bounded linear operator on Banach space represented in the time-frequency domain as a simple multiplier. Its properties make it useful in these applications as it can accurately represent pseudo-differential operators, model physical processes, and be intuitively designed by the practical user.

Speaker: **Matthew Mazowita** (University of Waterloo)

Title: *The LUC-compactification and Beurling algebras*

Abstract: The *LUC*-compactification of a locally compact group is a semigroup compactification which was used by Isik, Budak, and Pym to study the topological centre(s) of the group algebra. I will discuss the weighted analogue of the *LUC*-compactification (which fails to be a semigroup except in the trivial case) and present some new results and applications to Beurling (weighted group) algebras, including the topological centre and isomorphism problems.

Speaker: **Matthias Neufang** (Carleton University)

Title: *Measures of Arens irregularity*

Abstract: We shall report on recent progress on Arens irregularity, and discuss various notions measuring the degree to which a Banach algebra is irregular, such as the notions of extreme non Arens regularity and strong Arens irregularity, due to Granirer and Dales–Lau, respectively, *dtc* sets, and a new notion of metric Arens irregularity. The talk will in particular include the result that the Ghahramani–Lau conjecture (1995) on the strong Arens irregularity of the measure algebra of a locally compact group holds even in greater generality, namely for every Polish group. We shall also present a positive answer to a problem raised by Dales (2007) concerning the existence of small *dtc* sets for the algebra $LUC(G)^*$ over non locally compact groups G .

Speaker: **Varvara Shepelska** (University of Manitoba)

Title: *Weak amenability of weighted group algebras*

Abstract: Let G be a locally compact group, ω be a continuous weight function on G , and $L^1(G, \omega)$ be the corresponding Beurling algebra. Weak amenability of $L^1(G, \omega)$ for commutative groups G has been fully characterized by N. Gronbaek and Y. Zhang. In this talk, we discuss weak amenability of $L^1(G, \omega)$ for non-commutative locally compact groups G .

We first give examples to show that the condition that characterizes weak amenability of $L^1(G, \omega)$ for commutative groups G is no longer sufficient for the non-commutative case. However, we prove that this condition remains necessary for all [IN] groups G . We also provide a necessary condition for weak amenability of $L^1(G, \omega)$ of a different nature, which, among other things, allows us to obtain a number of significant results on weak amenability of $\ell^1(\mathbb{F}_2, \omega)$ and $\ell^1(\mathbf{ax} + \mathbf{b}), \omega$.

Finally, we discuss weak amenability of Beurling algebras on subgroups and quotient groups over normal subgroups. We give an example showing that $L^1(G, \omega)$ may not be weakly amenable even if both $L^1(H, \omega|_H)$ and $L^1(G/H, \hat{\omega})$ are weakly amenable, where the weight $\hat{\omega}$ on G/H is naturally induced from ω . On the other hand, we establish a sufficient condition under which weak amenability of $L^1(G, \omega)$ implies that of $L^1(G/H, \hat{\omega})$. In particular, with this approach, we prove that weak amenability of the tensor product $L^1(G_1, \omega_1) \hat{\otimes} L^1(G_2, \omega_2)$ implies weak amenability of both Beurling algebras $L^1(G_1, \omega_1)$ and $L^1(G_2, \omega_2)$, provided the weights ω_1, ω_2 are bounded away from zero. However, given a general weight on $G = G_1 \times G_2$, weak amenability of $L^1(G, \omega)$ usually does not imply weak amenability of $L^1(G_i, \omega|_{G_i})$ ($i = 1, 2$), even if both G_1, G_2 are commutative. We provide an example to illustrate this.

Speaker: **Nico Spronk** (University of Waterloo)

Title: *Amenability properties of central Fourier algebras of compact groups*

Abstract: Let G be a compact group, and let $ZA(G)$ be the *central Fourier algebra*, i.e., the algebra of those $u \in A(G)$ for which $u(x) = u(yxy^{-1})$ for each x, y in G . I will discuss amenability and weak amenability for these algebras. The latter property holds exactly when G admits no connected non-abelian subgroups. For virtually abelian G , $ZA(G)$ is amenable. I will present evidence for the converse, in particular infinite products of finite groups.

This represents joint work with M. Alaghmandan.

Speaker: **Ross Stokke** (University of Winnipeg)

Title: *Amenability for left dual Banach algebras*

Abstract: Ghahramani, Loy and Willis have shown that the bidual, $L^1(G)^{**}$, of a group algebra $L^1(G)$ of a locally compact group G is amenable only when G is finite. For dual Banach algebras, Connes-menability—a notion of amenability that takes account of the weak*-topology—is more appropriate than amenability: as just one of many examples, while amenability of a measure algebra $M(G)$ forces G to be discrete, V. Runde has shown that $M(G)$ is Connes amenable exactly when G is an amenable locally compact group. Unfortunately, many Banach algebras that are dual spaces, such as $L^1(G)^{**}$, usually fail to be dual Banach algebras and it therefore does not make sense to consider their Connes amenability.

In this talk, I will introduce a notion of left Connes amenability for left dual Banach algebras over a Banach algebra A and will discuss, for example, a theorem stating that amenability of G is equivalent to left Connes amenability of either $L^1(G)^{**}$ or $LUC(G)^*$, where $LUC(G)$ is the space of left uniformly continuous functions on G .

Speaker: **Nazanin Tahmasebi** (University of Alberta)

Title: *Hypergroups and complementation problems*

Abstract: A hypergroup is a locally compact Hausdorff space equipped with a convolution product which maps any two points to a probability measure with a compact support. Hypergroups generalize locally compact groups in which the above convolution reduces to a point mass measure. It was in the 1970s that Dunkl, Jewett and Spector began the study of hypergroups.

Let K be a hypergroup with a Haar measure. In this talk, I construct two correspondences: one between closed Weil subhypergroups and certain left translation invariant w^* -subalgebras of $L_\infty(K)$, and another between compact subhypergroups and a specific subclass of the class of left translation invariant C^* -subalgebras of $C_0(K)$. By the help of these two characterizations, I extract some results about invariant complemented subalgebras of $L_\infty(K)$ and $C_0(K)$.

Speaker: **Ya Shu Wang** (National Chung Hsing University)

Title: *Orthogonally additive holomorphic maps between Fourier algebras*

Abstract: Let G and H be locally compact groups, and let G have an abelian subgroup of finite index. Let $B_{A(G)}(0, r)$ be the open ball in the Fourier algebra $A(G)$ centered at 0 of radius $r > 0$. Suppose that $H : B_{A(G)}(0, r) \rightarrow A(H)$ is an orthogonally additive and disjointness preserving holomorphic map. We show that there exist weight functions w_n on H and a symbol map $\alpha : H \rightarrow G$ such that

$$Hu = \sum_{n \geq 1} w_n(u \circ \alpha)^n \quad (u \in B_{A(G)}(0, r)).$$

Speaker: **Matthew Wiersma** (University of Waterloo)

Title: *L^p -Fourier and Fourier–Stieltjes algebras*

Abstract: Let G be a locally compact group and $1 \leq p < \infty$. A continuous unitary representation $\pi : G \rightarrow B(H)$, with H being a Hilbert space, is an L^p -representation if, roughly speaking, many of the coefficient functions $G \ni s \mapsto \langle \pi(s)x, x \rangle$ are in $L^p(G)$ for $x \in H$. We investigate the norm-closed and weak*-closed coefficient spaces of the Fourier–Stieltjes algebra generated by the L^p -representations. These are always ideals of the Fourier–Stieltjes algebra containing the Fourier algebra and reflect properties of the underlying group G .