

**CAHAS 2010  
SCHEDULES OF TALKS**

All talks will be held in room 18, Edward School of Business (EBS).

**Thursday August 5**

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9:00-10:00: Jean Ludwig

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10:00-10:30: Coffee Break

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10:30-11:00: Fereidoun Ghahramani

11:00-11:30: Miad Makareh Shireh

11:30-12:00: Yemon Choi

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12:00-14:00: Lunch break

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14:00-14:30: Nico Spronk

14:30-15:00: Elcim Elgun

15:00-15:30: Laura Marti

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15:30-16:00: Coffee Break.

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16:00-16:30: Zhiguo Hu

16:30-17:00: Denis Poulin

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**Friday August 6**

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9:00-10:00: Matthew Daws

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10:00-10:30: Coffee Break.

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10:30-11:00: Keith Taylor

11:00-11:30: Qingde Yang

11:30-12:00: Michael Brannan

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12:00-14:00: Lunch Break

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14:00-14:30: Colin Graham

14:30-15:00: Cristian Ivanescu

15:00-15:30: Ben Willson

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15:30-16:00: Coffee Break.

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16:00-16:30: Volker Runde.

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**CAHAS 2010  
TITLES AND ABSTRACTS OF TALKS**

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**Michael Brannan** (Queen's University)

**Title:** A strong Haagerup inequality for free unitary quantum groups.

**Abstract:** It has been shown by T. Kemp and R. Speicher (2007) that the constants occurring in Haagerup's classical inequalities for the norms of convolution operators on the free group can be dramatically improved if one restricts attention to convolution operators which only involve the generators of the free group (but not their inverses).

In this talk, we will consider a class of compact quantum groups called the free unitary quantum groups, and show that a phenomenon similar to the one described above occurs in this quantized setting. Namely, we show that if one restricts to the non-self-adjoint subalgebra of a free unitary quantum group generated by the coefficients of its fundamental corepresentation (and not their adjoints), then the constants in a Haagerup inequality due to R. Vergnioux (2007) for these quantum groups also enjoy a substantial improvement. Our approach to this problem relies on combinatorial techniques from free probability theory.

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**Yemon Choi** (Université Laval)

**Title:** Directly finite group algebras: some examples and questions.

**Abstract:** An algebra with identity is said to be directly finite if each left-invertible element is automatically right-invertible; the definition has a natural generalization to the non-unital case also. It is an old observation (apparently due to Kaplansky) that the von Neumann algebra of a discrete group, and hence all its subalgebras, have this property. On the other hand, the group von Neumann algebra of  $SL_2(\mathbf{R})$  is not directly finite, but its full and reduced  $C^*$ -algebras are directly finite.

In this talk I will discuss these and related examples, after presenting some of the background. This is work in progress, motivated by some problems concerning residual spectra of convolution operators.

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**Matthew Daws** (University of Leeds, UK)

**Title:** Multipliers and Abstract Harmonic Analysis.

**Abstract:** Multipliers have been of interest to those studying harmonic analysis almost since the subject began. More recent study has focused on, say, completely bounded multipliers of the Fourier algebra, and the use of multipliers in the  $C^*$ -algebraic theory

of quantum groups. I've recently been interested in how far one can get by taking an abstract approach to multipliers, trying to involve specifics from harmonic analysis as late as possible.

In the first part of the talk I will try to develop a little bit of multiplier theory, somewhat in the abstract. I will use this to give a rather abstract proof that the (completely bounded) multipliers of the Fourier algebra form a dual Banach algebra (this is of course well known, but it should be clear, to those who know the definitions, that everything I do is equally valid for locally compact quantum groups).

In the second half of the talk, I will look at the notion of a Hopf Convolution Algebra, in the sense of Effros and Ruan. Again, I will develop this for the Fourier algebra, although links with quantum groups will be clear. I will show that one can replace the 'extended' Haagerup tensor product with a multiplier algebra, which makes clearer the analogy between the operator algebra level, and the convolution algebra level.

I will try to give a reasonably elementary talk: there are lots of open, and I think, interesting problems in this area, and it would be good to get some answers!

**Elcim Elgun** (University of Waterloo)

**Title:** Idempotents in the Eberlein compactification of  $\mathbb{Z}$ .

**Abstract:** The Eberlein Algebra  $\mathcal{E}(G)$  of a locally compact group  $G$  is defined to be the uniform closure of the Fourier-Stieltjes algebra of  $G$ .  $\mathcal{E}(G)$  satisfies certain invariance properties, hence for any locally compact group  $G$ , there exists a corresponding Eberlein compactification  $G^\mathcal{E}$  of  $G$ . In this talk, we will study  $\mathbb{Z}^\mathcal{E}$ , the Eberlein compactification of  $(\mathbb{Z}, +)$ . We will construct a family of  $2^c$  many idempotents in  $\mathbb{Z}^\mathcal{E}$ , which gives the exact cardinality of the lattice of idempotents in  $\mathbb{Z}^\mathcal{E}$ . This is an indication of the complexity of the structure of the semigroup  $\mathbb{Z}^\mathcal{E}$ .

**Fereidoun Ghahramani** (University of Manitoba)

**Title:**  $n$ -Weak Amenability Revisited.

**Abstract:** Let  $A$  be a Banach algebra, and for  $n = 1, 2, \dots$ , let  $A^{(n)}$  be the  $n$ -th continuous dual space of  $A$ . The space  $A^{(n)}$  is naturally a Banach  $A$ -bimodule. The Banach algebra  $A$  is  $n$ -weakly amenable if all the continuous derivations from  $A$  into  $A^{(n)}$  are inner;  $A$  is permanently weakly amenable if it is  $n$ -weakly amenable for all  $n$ . This talk is about some recent developments in the theory of  $n$ -weak amenability for certain Banach algebras in Harmonic Analysis. For example, permanent weak amenability of group algebras, approximate permanent weak amenability of the Segal algebras on SIN-groups, and  $n$ -weak amenability of Beurling algebras.

**Colin Graham** (UBC)

**Title:** Hadamard sets are  $FZI_0(U)$  with bounded constants.

**Abstract:** After 100 years of investigation, and 50 since Hadamard sets ( $1 < q \leq n_{j+1}/n_j$ ) were shown to be  $I_0$ , it is surprising that there is anything new to be learned. We show that interpolation can be done using non-negative discrete measures with arbitrarily small supports (dropping initial elements of the Hadamard set as the supports decrease).

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**Zhiguo Hu** (University of Windsor)

**Title:** Some regularity and irregularity problems over locally compact quantum groups.

**Abstract:** For a locally compact quantum group  $\mathfrak{G}$ , the right fundamental unitary induces a completely contractive multiplication on the space  $T(L_2(\mathfrak{G}))$  of trace class operators on  $L_2(\mathfrak{G})$  such that the quantum group algebra  $L_1(\mathfrak{G})$  becomes a quotient algebra of  $T(L_2(\mathfrak{G}))$ . In this talk, we shall discuss some regularity and irregularity problems around this operator convolution algebra and their relation to regularity of the quantum group in the sense of S. Baaj and G. Skandalis.

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**Cristian Ivanescu** (Grant MacEwan University)

**Title:** Cuntz semigroup and projectionless  $C^*$ -algebras.

**Abstract:** At this year's COSY meeting held in Fredericton, George Elliott restated his conjecture that simple separable amenable  $C^*$ -algebras are classified by the Cuntz semigroup together with the K1-group. Even though computations of the Cuntz semigroup are known to be difficult to obtain, it is of great importance to investigate possible calculations of the Cuntz semigroup. As Andrew Toms has shown, often the calculation of the Cuntz semigroup is equivalent with having the strong comparison property for positive elements. In my presentation I will review the definition of the Cuntz semigroup, certain type I projectionless  $C^*$ -algebras and their Cuntz semigroup. Also time permitting I will describe  $C_r^*(\mathbb{F}^2)$  which is known to be simple, separable and projectionless. A first step towards the calculation of its Cuntz semigroup is to check the strict comparison property for positive elements. This is still work in progress.

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**Jean Ludwig** (Université de Metz, France)

**Title:** The convolution algebras of locally compact groups.

**Abstract:** In this survey talk, we present some fundamental properties of the  $L^1$  and related algebras of a locally compact group  $G$ : the dual space and the group  $C^*$ -algebra of  $G$ , Fourier transform, minimal two sided ideals attached to closed subsets of  $\widehat{G}$ , Wiener property and sets of spectral synthesis, simple modules and symmetry.

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**Miad Makareh Shireh** (University of Manitoba)

**Title:** Topics in the notion of amenability for Banach algebras.

**Abstract:** For amenable Banach algebras  $A$  and  $B$ , we know that  $A \widehat{\otimes} B$  is amenable. However the converse is not known to be true. Before us B.E.Johnson has proved that the amenability of  $A \widehat{\otimes} B$  entails the amenability of  $A$  if the Banach algebra  $B$  has a certain property. However it is not known that the answer is positive even for the case where  $A = B$ . We prove that if the Banach algebra  $A$  has a bounded approximate identity, then the answer is positive. Since having a bounded approximate identity is a necessary condition for an amenable Banach algebra, our proof is significant enough. Indeed we show that for a Banach algebra  $A$  with a bounded approximate identity the followings are equivalent:

- (i)  $A$  is amenable.
- (ii)  $A \widehat{\otimes} A$  is amenable.
- (iii)  $A \widehat{\otimes} A^{op}$  is amenable.

Then we prove that if  $A$  is a closed ideal in a commutative Banach algebra  $B$ , then the (weak) amenability of  $A \widehat{\otimes} B$  entails (weak) amenability of  $A$ .

At the end of this talk, we give a partly different proof for Johnson's Theorem about the perturbation of Banach algebras and amenability that leads us to new result. We show that if a Banach algebra  $A$  is amenable with a multiplication  $\pi$ , then  $A$  is also amenable with any multiplication  $\rho$  such that  $\|\rho - \pi\| < \frac{1}{11}$ . We have discovered that the constant  $\frac{1}{11}$  is universal.

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**Laura Marti** (University of Waterloo)

**Title:** A continuous Fourier algebra for a locally compact groupoid.

**Abstract:** For a locally compact groupoid  $G$ , we define a Fourier algebra  $A(G)$ . If the groupoid is transitive and belongs to a class that includes the locally trivial and the  $r$ -discrete groupoids, we write  $A(G)$  as the Haagerup tensor product of spaces of continuous functions on the unit space of  $G$  and the Fourier algebra of its isotropy group.

This work is part of my PhD thesis, supervised by Prof. B. Forrest and Prof. N. Spronk.

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**Denis Poulin** (Carleton University)

**Title:** Strong Topological Center.

**Abstract:** For  $A$  and  $B$  two Arens regular Banach algebras, is  $A$  more Arens regular than  $B$ ? Formulated differently, can we compare two Banach algebras in terms of Arens regularity?

In this talk, we present introduce the concept of left and right strong topological center to answer the previous questions. First, we develop this concept for any Banach algebra and then obtain result to compare Banach algebra in term of their Arens regularity. We show how to use this new idea as a tool to study the group algebra and the Fourier algebra. Finally, we link the left multiplier algebra of the left strong topological center of  $A^{**}$  with the left multiplier algebra of  $A$ . In particular, we prove that for any Banach algebra  $A$  with a BAI,

$$LM(SZ_{\ell}(A^{**})) = LM(A).$$

**Nico Spronk** (University of Waterloo)

**Title:** Eberlein compactifications of locally compact groups.

**Abstract:** I will discuss compactifications of locally compact groups associated with unitary representations. I will discuss universal properties, relations to spaces of functions and give some examples. This is joint work with Ross Stokke.

**Keith Taylor** (Dalhousie University)

**Title:** From Projections to Wavelet Transforms.

**Abstract:** This talk will cover some of the recent developments in the theory of multi-variable continuous wavelet transforms and their connections with projections (self-adjoint idempotents) in the group algebra of integrable functions on appropriate locally compact groups.

**Volker Runde** (University of Alberta)

**Title:** Amenability of the Fourier algebra in the cb-multiplier norm.

**Abstract:** Brian Forrest and I showed that the Fourier algebra  $A(G)$  of a locally compact group  $G$  is amenable if and only if  $G$  is almost abelian. For non-abelian  $G$ , it often seems to make more sense not to look at  $A(G)$ , but at its completion in the (completely

bounded) multiplier norm. For instance, as Z.-J. Ruan has shown,  $A(G)$  is operator amenable if and only if  $G$  is amenable, but the completion of  $A(G)$  in the cb-multiplier norm is amenable, for instance, if  $G$  is the free group in two generators. Still, the problem of whether the completion of  $A(G)$  in the cb-multiplier norm can be amenable in the classical sense according to Johnson for  $G$  being a free group has been open so far. We report on some recent progress.

**Ben Willson** (University of Alberta)

**Title:** Characterizing hypergroup amenability with configurations.

**Abstract:** A hypergroup is a locally compact Hausdorff space equipped with an involution and convolution which turn the space of finite Borel measures on it into an involutive Banach algebra. In 2001, Rosenblatt and Willis gave a characterization of the amenability of a locally compact group using the existence of solutions to certain equations arising from configurations of colourings of the Cayley graph of the group. In this talk, I will present the more general notion of hypergroup configurations motivated by their work and recent results which characterize amenability for hypergroups and related properties.

**Qingde Yang** (University of Saskatchewan)

**Title:** Frame-Multiresolution Analysis on Certain Non-Abelian Locally Compact Groups.

**Abstract:** The theory of wavelets in the Hilbert space  $L^2(\mathbb{R}^d)$  has been received extensive studies. The principal framework for constructing and understanding wavelet bases for the Hilbert space  $L^2(\mathbb{R}^d)$  is the concept of multiresolution analysis (MRA). Dahlke extended MRA to the Hilbert space  $L^2(G)$ , where  $G$  is an abelian locally compact groups. We extend MRA further to the Hilbert space  $L^2(G)$ , where  $G$  is a certain non-Abelian locally compact group, which includes Heisenberg group as an important example. In order to discuss more general situations, we consider the frame-MRA rather than the regular MRA. We characterize the vectors that can serve as scaling vectors, which are the source of the frame-MRA. A few necessary and sufficient conditions under which a scaling vector generates a frame-MRA for  $L^2(G)$  are given. Concrete examples related to Heisenberg groups are provided to illustrate the theorems (Joint work with Keith F. Taylor).