

## Bialgebras in Free Probability

February 1 - April 22, 2011

Workshop on “Combinatorial, Bialgebra, and Analytic Aspects”

February 14 - 25, 2011

organized by M. Aguiar, F. Lehner, R. Speicher, D. Voiculescu

- **Monday, February 21**

**10:00 – 10:30:** Coffee

**10:30 – 11:20:** M. Aguiar: **Infinitesimal Bialgebras 1**

*Abstract:* We will review basic notions pertaining to infinitesimal bialgebras, as well as some new points of view motivated mainly by work of Voiculescu (Free Analysis Questions I and II). These will include:

- A discussion of the interplay between infinitesimal and Frobenius bialgebras.
- An algebraic perspective on the algebras of fully matricial functions of Voiculescu.

**11:30 – 12:20:** C. Krattenthaler: **Generalized non-crossing partitions for reflection groups and cyclic sieving**

**14:15 – 15:05:** T. Banica: **Probabilistic aspects of free quantum groups**

**15:05 – 15:30:** Coffee

**15:30 – 16:20:** B. Collins: **TBA**

**16:30 – 17:20:** M. Popa: **Non-commutative functions and some of their applications in free probability**

*Abstract:* Given two vector spaces,  $V$  and  $W$  over the complex numbers, a non-commutative function is, briefly, a mapping from a certain class of subsets of the matrix space over  $V$  to the matrix space over  $W$  satisfying some compatibility conditions: it has to respect direct sums and simultaneous similarities, or equivalently, simultaneous intertwinings. Noncommutative functions have very strong regularity properties and they admit a very nice differential calculus, closely related to some QD-bialgebras arising in free probabilities. Such objects were considered before by J. L. Taylor in his groundbreaking work on the noncommutative spectral theory, and more recently independently by D.-V. Voiculescu in free probability.

- **Tuesday, February 22**

**10:00 – 10:30:** Coffee

**10:30 – 11:20:** M. Aguiar: **Infinitesimal Bialgebras 2**

**11:30 – 12:20:** M. Mastnak: **Bialgebras and free multiplicative convolution**

*Abstract:* The talk is based on the joint paper with A. Nica entitled “Hopf algebras and the logarithm of the S-transform in free probability”. There we discuss a bialgebra based on non-crossing partitions that encodes some of the combinatorics of the free multiplicative convolution of  $k$ -tuples of distributions in a non-commutative probability space. The emphasis of the talk will be on bialgebra aspects of the work in question. Some related work in progress will also be mentioned.

**14:15 – 15:05:** C. Brouder: **Noncommutative Feynman graphs and Hopf algebra cohomology**

*Abstract:* Feynman graphs in quantum field theory can be generated as a convolution exponential over a free commutative algebra. We show that, similarly, any linear map  $f$  from the tensor algebra  $T(V)$  to the scalars (with  $f(1) = 1$ ), can be written as a convolution exponential and can be described with generalized non-commutative Feynman graphs. (joint work with Damien Manuel and Frederic Patras)

**15:05 – 15:30:** Coffee

**15:30 – 16:20:** L. Pastur: **Laws of Fluctuations for Spectral Statistics of Random Matrices**

*Abstract:* We present a review of recent results on the limiting laws for fluctuations of several classes of spectral statistics of random matrices as their size tends to infinity. We pay special attention to random matrices whose randomness is due Haar distributed random matrices of classical groups.

**16:30 – 17:00:** E. Redelmeier: **TBA**

**All lectures take place in the ESI Boltzmann Lecture Hall**