

Workshop in Strasbourg
Journées ANR sur la Conjecture du Volume

17–19 September 2007

Speakers

Jørgen ANDERSEN (Århus)
Stéphane BASEILHAC (Grenoble)
Riccardo BENEDETTI (Pisa)
Francis BONAHOON (Los Angeles)
François COSTANTINO (Strasbourg)
Jérôme DUBOIS (Barcelona)
Stavros GAROUFALIDIS (Atlanta)
François GUERITAUD (Paris)
Rinat KASHAEV (Genève)
Bertrand PATUREAU-MIRAND (Vannes)
Roland VAN DER VEEN (Amsterdam)

This workshop is funded by the ANR (*Agence Nationale de la Recherche*), and is organized by S. Baseilhac, F. Costantino and G. Massuyeau.

For more informations, please visit the workshop website at

<http://www-irma.u-strasbg.fr/article438.html>

Program

Monday 17 September

- 9:00-9:30 Registration
- 9:30-10:30 F. Bonahon
Using quantum Teichmüller theory to represent the braid group
- 10:30-11:00 Coffee break
- 11:00-12:00 S. Garoufalidis
Resurgence in Quantum Topology: what is it, and why should we care?
- 14:00-15:00 B. Patereau-Mirand
Multivariable link invariants
- 15:00-15:30 Coffee break
- 15:30-16:30 F. Guéritaud
The Laurent phenomenon and total positivity

Tuesday 18 September

- 9:30-10:30 R. Kashaev
On rings associated with knots
- 10:30-11:00 Coffee break
- 11:00-12:00 S. Garoufalidis
Concrete asymptotics of classical and quantum 6j-symbols
- 14:00-15:00 J. Dubois
Reidemeister torsion and Chern–Simons invariant appear in the asymptotic expansion of the colored Jones polynomial for torus knots
- 15:00-15:30 Coffee break
- 15:30-16:30 F. Costantino
On a shadow-approach to the Volume Conjecture

Wednesday 19 September

- 9:30-10:30 R. Benedetti
About quantum hyperbolic partition functions
- 10:30-11:00 Coffee break
- 11:00-12:00 J. Andersen
The mapping class groups do not have Kazhdan’s Property (T)
- 14:00-15:00 R. van der Veen
The Volume Conjecture for augmented knotted trivalent graphs
- 15:00-15:30 Coffee break
- 15:30-16:30 S. Baseilhac
Tropical views on cusped manifolds

Abstracts

J. ANDERSEN: *The mapping class groups do not have Kazhdan's property (T).*

“ We prove that the mapping class group of a closed oriented surface of genus at least two does not have Kazhdan's property (T). We use Reshetikhin–Turaev quantum representations of the mapping class groups to construct a Hilbert space representation of the mapping class group. By a theorem of J. Roberts this representation does not have fixed vectors. We construct an almost fixed vector for this representation by applying the theory of coherent states and the theory of Toeplitz operators to the construction of the representation via geometric quantization of moduli spaces. ”

S. BASEILHAC: *Tropical views on cusped manifolds.*

“ The 3-manifold invariants of cusped manifolds arising from quantum hyperbolic geometry are defined on a sequence of amoebas of complex curves. We will discuss its degeneration as the level goes to infinity. ”

R. BENEDETTI: *About quantum hyperbolic partition functions.*

“ We will discuss some structural features and a few experimental evidences (about the asymptotic behaviour) of the QHFT partition functions built (in joint works with S. Baseilhac) on the matrix dilogarithms. ”

F. BONAHO: *Using quantum Teichmüller theory to represent the braid group.*

“ Quantum Teichmüller theory is very closely related to Kashaev's original presentation of the Kashaev invariant. We will explain how to use quantum Teichmüller theory to construct projective representations of the braid groups of the sphere. We will conclude with some speculations on the Volume Conjecture in this context. ”

F. COSTANTINO: *On a shadow-approach to the Volume Conjecture.*

“ I will propose and discuss a version of the Generalized Volume Conjecture based on shadow-state sums expressing the colored Jones polynomials of links. I will prove this version of the conjecture for all the universal hyperbolic links starting from the Murakami–Yano–Ushijima formula for the volume of a truncated hyperbolic tetrahedron. ”

J. DUBOIS: *Reidemeister torsion and Chern–Simons invariant appear in the asymptotic expansion of the colored Jones polynomial for torus knots.*

“ Let $\langle K \rangle_N$ be the Kashaev invariant (a specialization of the colored Jones polynomial). For torus knots, the Volume Conjecture is well-known and trivially true in the sense

that

$$\lim_{N \rightarrow \infty} \frac{\log |\langle K \rangle_N|}{N} = 0.$$

In fact, $\langle K \rangle_N \sim N^{3/2}$ for large N .

In this talk, I will take into pieces the asymptotic expansion of $\langle K \rangle_N$ for torus knots. More precisely, I will explain that the non-abelian Reidemeister torsion (with coefficients in the adjoint representation) and the Chern–Simons invariant (for the knot exterior) appear as subleading terms in the asymptotic expansion of $\langle K \rangle_N$. ”

S. GAROUFALIDIS: *Concrete asymptotics of classical and quantum 6j-symbols.*

“ The classical 6j-symbols depend on 6 parameters that can be arranged as the edges of a metric tetrahedron. We will discuss in detail and concretely the case of the regular euclidean tetrahedron with edge-lengths 1, and we will prove the existence of a concrete asymptotic expansion with leading terms two complex numbers in the unit circle. Our formula corrects some numerical errors in J. Robert’s theorem and 30+years old physics literature. Our proof (which generalizes without change to the quantum 6j-symbols, regular or not) uses elementary algebraic ideas of WZ theory, together with a recently solved resurgence conjecture for single sums of hypergeometric functions. This is a joint work with Roland van der Veen, conceived during an unexpected bus-ride to the Billund airport at the end of the June 2007 Århus conference. ”

S. GAROUFALIDIS: *Resurgence in Quantum Topology: what is it, and why should we care?*

“ We will formulate a general resurgence conjecture in Quantum Topology that covers the cases of manifolds with/without torus boundary and implies the Volume and Witten Conjectures to all orders, with exponentially small terms included, in an exact form. We will also discuss a proof of this resurgence conjecture for single sums of quantum factorials. ”

F. GUÉRITAUD: *The Laurent phenomenon and total positivity.*

“ An inductively defined family of rational functions in several variables can surprisingly turn out to be a family of Laurent series. Fomin and Zelevinsky gave an algebraic explanation of this “Laurent phenomenon”, which we will outline in the lecture. Examples include rational functions which describe chart maps in Teichmüller space, and their deformations. Moreover, the Laurent series are often totally positive, although this has been shown only in a few special cases. ”

R. KASHAEV: *On rings associated with knots.*

“ I will talk about some ring valued invariants of knots and explain how to calculate them in few concrete examples. ”

B. PATUREAU-MIRAND: *Multivariable link invariants.*

“ We will present some multivariable link invariants related to Lie superalgebras and quantum groups at root of unity. They can be thought of as generalizations of the multivariable Alexander polynomial and Kashaev’s invariants. ”

R. VAN DER VEEN: *The Volume Conjecture for augmented knotted trivalent graphs.*

“ We propose to extend the Volume Conjecture to knotted trivalent graphs (KTGs) and show that it holds for all augmented KTGs. By an augmented KTG we mean a KTG to which a number of unknotted, mutually unlinked components have been added in a specific way. ”

Confirmed participants

Norbert A'CAMPO, Universitaet Basel,
Norbert.Acampo@unibas.ch

Daniele ALESSANDRINI, Università di Pisa,
daniele.alessandrini@gmail.com

Jørgen ANDERSEN, Århus Universitet,
andersen@imf.au.dk

Stéphane BASEILHAC, Université de Grenoble I,
stephane.baseilhac@ujf-grenoble.fr

Alex BENE, Århus Universitet,
bene@imf.au.dk

Riccardo BENEDETTI, Università di Pisa,
benedett@dm.unipi.it

Francis BONAHOON, University of Southern California,
fbonahon@math.usc.edu

François COSTANTINO, Université de Strasbourg I,
costanti@math.u-strasbg.fr

Jérôme DUBOIS, Universitat Autònoma de Barcelona,
JDubois@crm.cat

Stavros GAROUFALIDIS, Georgia Institute of Technology,
stavros@math.gatech.edu

François GUERITAUD, Université de Paris XI,
gueritau@dma.ens.fr

Rinat KASHAEV, Université de Genève,
Rinat.Kashaev@math.unige.ch

Christian KASSEL, Université de Strasbourg I,
kassel@math.u-strasbg.fr

Julien MARCHE, Université de Paris VI,
marche@math.jussieu.fr

Gregor MASBAUM, Université de Paris VII,
masbaum@math.jussieu.fr

Gwénaél MASSUYEAU, Université de Strasbourg I,
massuyeau@math.u-strasbg.fr

Jean-Baptiste MEILHAN, Århus Universitet,
meilhan@math.ucr.edu

Hugh MORTON, University of Liverpool,
morton@liv.ac.uk

Frédéric PALESI, Université de Grenoble I,
frederic.palesi@ujf-grenoble.fr

Athanase PAPADOPOULOS, Université de Strasbourg I,
papadopoulos@math.u-strasbg.fr

Bertrand PATUREAU-MIRAND, Université de Bretagne-Sud,
bertrand.patureau@univ-ubs.fr

Guillaume THERET, Århus Universitet,
theret@imf.au.dk

Roland VAN DER VEEN, Universiteit van Amsterdam,
riveen@science.uva.nl

Maxime WOLFF, Université de Grenoble I,
wolff@ujf-grenoble.fr