Abstracts of talks "Geometry, Topology and Group Theory" in honor of the 80th birthday of Valentin Poenaru
July 1-6, 2012
Conference in Autrans

Michel Boileau: **Commensurability classes of hyperbolic knot complements and hidden symmetries**
We talk about commensurability classes of hyperbolic knot complements. In the generic case of knots without hidden symmetries, knot complements which are commensurable are cyclically commensurable. Moreover there are at most 3 hyperbolic knot complements in such a commensurability class and strong restrictions on the knots which have commensurable complements. We will discuss open questions and some new results in the case of knots with hidden symmetries. This is a joint work with S. Boyer, R. Cebanu et G. Walsh.

François Costantino: **On skein algebras and representations of mapping class groups**
The skein algebra of a surface is an associative (but not necessarily commutative) algebradepending on a complex parameter sometimes called "quantum parameter". Even if their definition is quite combinatorial (they areassociated to surface by imposing Kauffman bracket relations on the vector space generated by links in the thickened surfaces), the skein algebras have deep connections with geometry; in particular they provide infinitely many representations of mapping class groups. After recalling the main facts on skein modules of manifolds and skein algebras of surfaces, we will discuss some of the known relations with the geometry of the $SL_2(C)$ character varieties of surfaces when the quantum parameter tends to -1 (the so-called "semiclassical limit"). Then we will introduce the "quantum spin networks" as orthogonal bases for these algebras and we will discuss a recent result (joint with Bruno Martelli) studying the limit of the representations when the parameter tends to 0.

Bertrand Deroin: **Levi-flat hypersurfaces in surfaces of general type**
In a complex surface, a real hypersurface is called Levi-flat if it is locally pseudo-convex from both sides. We will describe the possible geometries (in the sense of Thurston) that can arise for atoroidal Levi-flats in general type surfaces. This is a joint work with Christophe Dupont.

Cornelia Druţu: **The Rapid Decay property for small cancellation groups**
In this talk I shall overview the property of Rapid Decay and I shall explain why certain small cancellation groups have this property. This is joint work with Goulnara Arzhantseva.

Jérôme Dubois: **Alexander invariants in knot theory : from classical type to L^2 type**
Alexander invariants appear in different flavors which are all closely related to Reidemeister torsion theory : 1. the classical one or the original Alexander invariant introduced in the 1930's which can be considered as an abelian invariant; 2. twisted ones introduced in the 1990's which can be considered as a non abelian invariant, and which use the theory of character varieties; 3. the L^2 one introduced in the 2000's, which uses the theory of L^2 invariants and gives a new type of knot invariant that in a sense generalizes the hyperbolic volume. I will discuss some properties of these invariants and focus on some similarities and differences between these families of invariants.

Ross Geoghegan: **Horospherical Limit Points: linking three distinct areas**
Let the group G act by isometries on a proper CAT(0) space M, and let A be a finitely generated ZG-module. With this double action of G (geometric on M and algebraic on A) comes the set of horospherical limit points of the module A over the space M. It is a subset of the visual boundary of M.

This horospherical limit set has interesting interpretations in several areas:

(1) in the case when M is Gromov-hyperbolic it gives a geometric criterion for deciding when A is finitely generated over a given normal subgroup of G;

(2) in the flat case, where M is a Euclidean space and G is finitely generated free abelian acting by translations, it is (the integer analog of) the tropicalization of a certain algebraic variety;

(3) in the case of $G = SL_n(\mathbb{Z})$ acting on its symmetric space, it appears, at least conjecturally, as an interesting associated building when the boundary is retopologized by the Tits metric.

I will talk about these ideas. This is joint work with Robert Bieri, growing out of his original work on the Bieri-Neumann-Strebel invariant (which I'll define).

Rinat Kashaev: **The pentagon equation and mapping class group representations**
Using the combinatorics of the (decorated) surface ideal triangulations , one can define a connected groupoid having the mapping class group as its vertex group and which admits a very simple presentation independent of the topological type of the surface . It permits to construct a large family of mapping class group representations by using realizations of a simple algebraic system containing the pentagon equation. I will illustrate the construction by examples coming from classical and quantum Teichmller theories.

Erwan Lanneau: **Dynamics of $SL(2,\mathbb{R})$ on Prym eigenforms**
The dynamics of the linear flow on a translation surface is closely related to its $SL(2,\mathbb{R})$-orbit closure inside the moduli space. The goal of this talk is to present a complete classification of closed $SL(2,\mathbf{R})$-invariant sets, for some moduli spaces. (This is a joint work with Duc-Manh Nguyen).

François Laudenbach: **Morse complexes for manifolds with non-empty boundary, A_∞-structures and application to classical links**
Given a generic Morse function on a manifold with non-empty boundary, I defined two Morse complexes, yielding respectively the absolute homology and the homology relative to the boundary. Both of them are endowed with multiplicative structures, an A_∞-structure indeed (joint work with C. Blanchet), extending K. Fukaya's work for closed manifolds. When this is applied to the complement in the 3-sphere of a tubular neighborhood of a link, equipped with the standard height function, the Massey product is seen from a Morse point of view.

Gilbert Levitt: **Automorphisms of relatively hyperbolic groups**
I will describe various results about automorphisms of relatively hyperbolic groups, and some of the techniques used to prove them.

Jérôme Los: **Volume entropy for surface groups**
The volume entropy of a group is a function that depends in a highly non trivial way on the group presentation. Computing or even evaluating this function from the presentation is known only for free groups (with free presentation). In this talk I'll describe a dynamical approach, coming from ideas of R.Bowen and C. Series that allow to give an exact computation for a specific class of presentations for surface groups, called geometric.

Ciprian Manolescu: **A combinatorial approach to Heegaard Floer invariants**
Heegaard Floer theory, introduced by Ozsvath and Szabo, is a useful technique in low-dimensional topology: in particular, in four dimensions, it gives rise to invariants that are conjecturally the same as the Seiberg-Witten invariants, and share many of their properties. In this talk, I will describe an algorithm for computing the Heegaard Floer invariants of three- and four-manifolds (modulo 2). The algorithm is based on presenting the manifolds in terms of links in S3, and then using grid diagrams to represent the links. The talk is based on joint work with P. Ozsvath and D. Thurston.

Julie Marché : **Ergodicity of the Torelli group on representation spaces**
Given a compact oriented surface without boundary S and a group G, the modular group Mod(S) acts on the space $M(S, G)$ of representations of the fundamental group of S in G. In the case when $G = PSL_2(\mathbb{R})$, the group Mod(S) acts properly on the Teichmuller component but in the case when $G = SU_2$, Goldman showed that the action was ergodic. The aim of this talk is to show that the Torelli group (those elements of Mod(S) which act trivially on $H_1(S)$) still acts ergodically. This is joint work with L. Funar.

Barry Mazur: **Primes, Knots, and Po**

Daniele Otera: **Comparison and measure of tameness conditions of groups**
Following a concept developed by Poenaru in the 80's, S.Brick and M.Mihalik introduced the so-called qsf property (meaning "quasi-simply-filtered"): a topological property for spaces which is also well-defined for finitely presented groups. In the talk I will describe the relations between the qsf and some other tameness topological conditions for groups and spaces (e.g. the geometric simple connectivity), and I will compare their growth functions.

Athanase Papadopoulos: **Actions of mapping class groups**
I will present some rigidity theorems on actions of mapping class groups on various simplicial complexes and on spaces of foliations which I obtained in the last few years, some of them with co-authors (McCarthy, Korkmaz, Charitos and Papadoperakis). I will also mention some recent results of Ohshika on the same theme.

Mark Sapir: **Aspherical manifolds with extreme properties**
We prove that every finitely generated aspherical group embeds into the fundamental group of a compact aspherical manifold. This implies that there exist compact aspherical Riemannian manifolds of dimension 4 with infinite asymptotic dimension, without Yu's property A, whose fundamental group does not coarsely embed into a Hilbert space and does not satisfy Baum-Connes conjecture with coefficients.

Andrzej Zuk: **On a problem of Atiyah**
In 1976, Michael Atiyah defined L2-Betti numbers for manifolds and asked a question about their rationality. These numbers arise as the von Neumann dimensions of kernels of certain operators acting on the L2-space of the fundamental group of a manifold. The problem concerning their values is closely related to the Kaplansky zero-divisor question. We present constructions of closed manifolds with irrational L2-Betti numbers.