Detailed Schedule of the Bianchi Modularity Workshop

Monday 11 July 2015

- 10.15 - 11.00 *coffee and registration in B02*
- 11.00 - 12.00 Lassina Dembélé: **On the existence of abelian surfaces with everywhere good reduction**
  Abstract: A famous result of Fontaine (and Abrashkin) states that there is no abelian variety over the rationals with everywhere good reduction. Fontaine's proof of this result relies on the non-existence of certain finite flat group schemes. His technique has been refined by several people (including Schoof, Brumer and Calegari) to prove non-existence of semi-stable abelian varieties over various fields. But one has to expect that such non-existence results are the exception rather than the norm. Indeed, as the base field varies, we must hope to find more abelian varieties with everywhere good reduction.
- *Lunch break*
- 14.15 - 15.15 Dan Yasaki: **Computing Bianchi modular forms using polytopes**
  Abstract: The theory of modular symbols allows explicit computation of classical modular forms. These ideas have been extended by Cremona and his students to a more general setting. This can be described in terms of an associated polyhedron coming from the study of perfect n-ary forms using work of Gunnells. In this talk we describe this relationship for imaginary quadratic fields and give some examples of these computations.
- *Coffee*
- 16.00 - 17.00 Herbert Gangl: **Hyperbolic polyhedra from Bianchi groups**
  Abstract: We produce ideal tessellations of the upper half space via groups commensurable with Bianchi groups. In this rather recreational talk we exhibit new hyperbolic polytopes with many vertices and hidden symmetries.

Tuesday 12 July 2015

- 09:30 - 10:30 Günter Harder: **Explicit computation of denominators of Eisenstein cohomology classes**
  Abstract: I think that it is a major task to write a computer program which computes the cohomology $H^\bullet(\Gamma\backslash X, \mathcal{M}_\mathbb{Z})$ the restriction map to the boundary cohomology

  $$r : H^\bullet(\Gamma\backslash X, \mathcal{M}_\mathbb{Z}) \to H^\bullet(\partial(\Gamma\backslash X), \mathcal{M}_\mathbb{Z})$$

  and an explicit formula for a Hecke operator T_p acting on these modules. Here explicit means to write these cohomology groups as direct sums of cyclic groups with generators e_i and giving explicit matrices for r, T_p.
  Such a program would give us the denominators of Eisenstein classes and we could verify the conjectural congruences between elliptic and Siegel modular forms experimentally.
  Such a program has been written by H. Gangl and myself for $\Gamma = \mathrm{SL}_2(\mathbb{Z})$.
  I will discuss a very "theoretical" version of such a program.
- *Coffee*
- 11:00 - 12:00 M. Haluk Sengun: **K-theory around arithmetic groups**
  Abstract: The ordinary cohomology of arithmetic groups, endowed with the action of Hecke operators, plays an important role in the theory of automorphic forms and in the Langlands programme. Could replacing ordinary cohomology with K-theory offer new insight or reveal new phenomena?

  In this talk, I will present some highlights of joint work with Bram Mesland (Hannover) in which we take the first steps to attack the above question in the case of Bianchi groups.
- *Lunch break*
- 14:15 - 15:15 Tobias Berger: **Deformations of Saito-Kurokawa type**
  Abstract: I will report on work in progress with Kris Klosin on the modularity of 4-dimensional symplectic representations whose reductions mod p are of Saito-Kurokawa type. This can be used to verify the paramodular conjecture of abelian surfaces over $\mathbb{Q}$ with a rational torsion point of order p in certain examples. I will also discuss the possibility of applying this to the modularity of elliptic curves over imaginary quadratic fields.
- *Coffee*
- 16:00 - 17:00 Aurel Page: **Torsion homology of hyperbolic 3-manifolds in Jacquet-Langlands pairs and isospectral pairs**
  Abstract: I will first sketch an algorithm to compute fundamental domains, homology and Hecke operators for arithmetic Kleinian groups, including Bianchi groups. I will then describe ongoing work with Haluk Sengun where we numerically test and prove instances of the torsion Jacquet-Langlands conjecture, as formulated by Calegari and Venkatesh. I will explain the role played by "regulators" in the known results towards this conjecture, and present joint work with Alex Bartel on the behaviour of torsion homology and regulators in the less arithmetic but more tractable situation of Sunada's construction of isospectral manifolds.

Wednesday 13 July 2015

- 09:30 - 10:30 Lucio Guerberoff: **Critical values of L-functions of potentially automorphic motives**
  Abstract: In this talk, I will discuss some results on Deligne's conjecture for potentially automorphic motives, twisted by certain algebraic Hecke characters. I will explain how to prove a version of the conjecture, choosing the characters in such a way that we can use automorphic methods in the context of totally definite unitary groups. This is joint work with Daniel Barrera Salazar.
- *Coffee*
- 11:00 - 12:00 David Kohel: **Characterizing Galois representations by character theory**

  Abstract: We describe a method for characterizing Galois distributions, for example, the Frobenius distributions arising as the Sato-Tate group of an abelian variety or associated to a modular form or a family of exponential sums. We develop an approach to characterize it through the character theory of compact Lie groups and their orthogonality relations. This is joint work with Gilles Lachaud and Yih-Dar Shieh.
- *Lunch break*
- 17:00 *Hike around Luxembourg*
- 19:00 *Conference Dinner*

Thursday 14 July 2015

- 09:30 - 10:30 Jean Raimbault: **Asymptotic geometry of arithmetic hyperbolic 3-manifolds**
  Abstract: I will explain various conjectures (and a few results) about the geometry of arithmetic hyperbolic manifolds of large volume, and how they pertain to limit multiplicities results for automorphic forms. In particular I will discuss Bianchi groups and their cohomology for large discriminants.
- *Coffee*
- 11:00 - 12:00 David-Alexandre Guiraud: **Generic unobstructedness for compatible systems of Galois representation in the CHT-setting**
- *Lunch break*
- 14:15 - 15:15 Ariel Pacetti: **Elliptic curves over PID imaginary quadratic fields**
  Abstract: In this talk we will present a method to compute elliptic curves over imaginary quadratic fields of class number 1. We will concentrate in the prime conductor case, and present a conductor-discriminant relation. We will end the talk with general comments on the data obtained.
- *Coffee*
- 16:00 - 17:00 Sara Arias de Reyna: **On an automorphy result for the tensor product of automorphic representations of $\mathbf{GL}_2$ and $\mathbf{GL}_n$ in the self-dual case**

  Abstract: In this talk I will discuss a joint work with Luis Dieulefait, where we address a case of Langlands functoriality for tensor products. More precisely, given a classical modular form f of level 1 without CM and an automorphic representation of $\mathrm{GL}_n(\mathbb{A}_{\mathbb{Q}})$ which is RAESDC, subject to mild conditions, we prove that the tensor product of these two automorphic representations is automorphic. I will describe the general strategy and the main tools appearing in the proof.

Friday 15 July 2015

- 10:00 - 11:00 Luis Dieulefait: **Chains of congruences linking Hilbert modular forms**
- *Coffee*
- 11:30 - 12:00 Individual work, networking and spontaneous scientific discussions in the lecture hall
- *Lunch break*