Moduli and Automorphic Forms:
A meeting for women in mathematics

May 12 – May 14, 2016

SCHEDULE

Thursday, May 12

Time	Speaker	*Title of Talk*
09:00-09:45		–Registration–
09:45-10:45	Vignéras	*Representations modulo p*
10:45-11:30		–Coffee Break–
11:30-12:30	Colombo	*On the second fundamental form of the Torelli map and applications to totally geodesic subvarieties of A_g in the Torelli locus and to complex projective structures*
12:30-14:00		–Lunch Break–
14:00-15:00	Ramdorai	*Birational motives and birational geometry*
15:00-15:30		–Coffee Break–
15:30-16:30	Sarti	*A relation between the moduli space of some irreducible holomorphic symplectic fourfolds and the moduli space of cubic threefolds*
16:30-17:30	Castravet	*Moduli spaces of pointed stable rational curves*

Friday, May 13

Time	Speaker	*Title of Talk*
09:00-10:00	Viehmann	*Geometry of Newton strata*
10:00-10:30		–Coffee Break–
10:30-11:30	Melo	*Universal compactified Jacobians and applications*
11:30-12:30	Vlasenko	*Higher Hasse–Witt matrices*
12:30-14:15		–Lunch Break–
14:15-15:15	Arbarello	*BMS Friday Colloquium*
15:15-15:45		–Coffee Break–
15:45-16:45	Wendland	*Moduli and modular forms in conformal field theory*

Saturday, May 14

Time	Speaker	*Title of Talk*
09:30-10:30	Elias	*Kolyvagin's method of Euler systems applied to modular forms twisted by algebraic Hecke characters*
10:30-11:00		–Break–
11:00-12:00	di Rocco	*Higher order Gauss maps*
12:00-13:00	Bauer	*Line configurations and new rigid surfaces*

VENUES

On *Thursday and Saturday*, the conference takes place in the Erwin Schrödinger-Zentrum of the Humboldt-Universität zu Berlin, Rudower Chaussee 26, 12489 Berlin-Adlershof. The lectures will take place in the **Lecture Hall 0'307** which is situated on the ground floor of the building. There is the following exception: *The first lecture on Thursday* will take place in the **Lecture Hall 0'311**.

On *Friday*, the conference takes place at URANIA, An der Urania 17, 10787 Berlin. The lectures will take place in the **BMS Loft** of the Berlin Mathematical School (BMS).

CONFERENCE DINNER

The conference dinner is scheduled for **Friday, May 13, at 19.30**. The venue for this dinner is the

Restaurant Neumond, Tieckstr. 12, 10115 Berlin,

which is in a 10 minutes walking distance from the train station U Oranienburger Tor.

TITLES AND ABSTRACTS

Ingrid Bauer	**Line configurations and new rigid surfaces** Given an algebraic variety defined by a set of equations, an upper bound for its dimension at one point is given by the dimension of the Zariski tangent space. And the implicit function theorem gives a local parametrization at a smooth point. The infinitesimal deformations of a variety X play a somehow similar role, they yield the Zariski tangent space at the local moduli space, when this exists. It may happen that this moduli space consists of a point (or even a reduced point) if there are no infinitesimal deformations. In this case one says that X is rigid, (respectively infinitesimally rigid). In dimension 1 the only example is the projective line. In dimension 2 we show that rigid surfaces are either the Del Pezzo surfaces of degree ≥ 5, or are some minimal surfaces of general type. The list of known rigid surfaces of general type is rather short: they are all uniformised by the ball or the bidisk, or are the examples of Mostow and Siu, or the Kodaira fibrations of Catanese–Rollenske. We discuss Abelian coverings branched on certain line arrangements as a class of new rigid surfaces and prove the rigidity for Hirzebruch–Kummer coverings of the plane branched over a complete quadrangle. I will finish mentioning other examples and several open questions. (This is joint work with Fabrizio Catanese).

Ana-Maria Castravet	**Moduli spaces of pointed stable rational curves** After an introduction to the geometry of the various compactifications of the configuration space of distinct points on the projective line, I will report on a joint work with Jenia Tevelev on Kuznetsov's conjecture on the derived category of moduli of pointed stable rational curves and related spaces.

Elisabetta Colombo	**On the second fundamental form of the Torelli map and applications to totally geodesic subvarieties of A_g in the Torelli locus and to complex projective structures** I will describe the second fundamental form of the Torelli map in term of the multiplication by the section of a line bundle. We use this description to study Shimura varieties in the moduli space of curves. Moreover, we show how it is related to complex projective structures on Riemann surfaces. All this is joint work with P. Frediani and A. Ghigi.

Yara Elias	**Kolyvagin's method of Euler systems applied to modular forms twisted by algebraic Hecke characters** We bound the size of the Selmer group associated to a modular form and an algebraic Hecke character using an Euler system of generalized Heegner cycles. The main argument is based on Kolyvagin's method adapted by Bertolini and Darmon and by Nekovar while the key tool, namely the algebraic cycles forming the Euler system were first considered by Bertolini, Darmon, and Prasanna.

Margarida Melo	**Universal compactified Jacobians and applications** In the talk I will give an overview of the theory of compactified Jacobians of singular curves as well as their universal versions. Special emphasis will be given to enumerate a number of applications of the theory, some being already quite well understood, and others being only conjectural.

Sujatha Ramdorai	**Birational motives and birational geometry** This talk will introduce some old and new birational invariants in Algebraic Geometry. We will also define the category of birational motives and study the morphisms in this category. This is joint work with Bruno Kahn.

Sandra di Rocco	**Higher order Gauss maps** The Gauss map is an important and fundamental tool in algebraic and differential geometry. We will present generalisations, so called higher order Gauss maps, capturing higher order local positivity and tangency. The main goal of the talk is to explain these (rational) maps and to show that if the variety is smooth and the Gauss map of order k is a regular map, than it is finite except in the case of the k-th Veronese embedding. This is a straight forward generalisation of the classical case. If time permits a toric interpretation will be presented. This is joint work with A. Lundman and K. Jabbusch.

Alessandra Sarti	**A relation between the moduli space of some irreducible holomorphic symplectic fourfolds and the moduli space of cubic threefolds** In a famous paper Allcock, Carlson and Toledo describe the moduli space of cubic threefolds as a ball quotient. After introducing basic facts on hyperkähler manifolds and automorphisms, I give an interpretation of the previous moduli space as moduli space of some special irreducible holomorphic symplectic fourfolds with a non-symplectic automorphism of order three. This is a joint work with S. Boissière and C. Camere.

Eva Viehmann	**Geometry of Newton strata** The Newton stratification is one of the central tools to study the reduction of Shimura varieties. I will introduce this stratification and discuss recent results on the geometry of strata, including very foundational ones such as non-emptiness, dimensions, irreducible components and closure relations.

Marie-France Vignéras	**Representations modulo p** Let p be a prime number, F a finite extension of Q_p, and C an algebraically closed field of characteristic p. We consider smooth representations over C. Most people believe that there exists a relation between the representations of the absolute Galois group Gal_F and the representations of the groups $G(F)$ of rational points of connected reductive F-groups G, as in the case where $G(F) = GL(2, Q_p)$ (Breuil, Colmez). The existence of a general local Langlands correspondence modulo p is not seen at the level of the irreducible representations of Gal_F and of $G(F)$, and the link could be through the pro-p Iwahori Hecke C-algebra H of $G(F)$. Große-Klönne constructed a functor from the finite dimensional H-modules to the finite dimensional representations of Gal_{Q_p}. We will give some properties of the functor of invariants by the pro-p Iwahori subgroup from the representations of $G(F)$ to the H-modules, obtained in collaboration with Abe, Henniart, Herzig, and Ollivier.

Masha Vlasenko	**Higher Hasse–Witt matrices** Let X be a smooth projective hypersurface of dimension n. In the 70s Leonard Miller showed that the coefficients of the Hasse–Witt operator in the 'monomial' basis in the space of global n-forms on X are given by certain coefficients of the $(p-1)$-th power of the equation of X reduced modulo p. We develop this construction to produce a sequence of matrices whose reductions modulo p give the iterates of the Hasse–Witt operator. Whenever the Hasse–Witt operator is invertible, our matrices satisfy a rich system of congruences modulo powers of p. These congruences yield p-adic limit formulas, which conjecturally describe the Gauss–Manin connection and the Frobenius operator on the unit-root F-crystal constructed in the 80s by Nicholas Katz.

Katrin Wendland	**Moduli and modular forms in conformal field theory** Conformal field theories (CFTs) are examples of quantum field theories with conformal symmetry. In particular, the vector space of states of such a theory carries a representation of the so-called Virasoro algebra, a Lie algebra that arises from the infinitesimal conformal transformations of the punctured complex plane. While a full mathematical treatment of CFT is technically very demanding, this singles out aspects of CFT which become tractable by well-established techniques from representation theory. In particular, the so-called partition function of a CFT, which keeps track of the dimension of the space of states at any given energy level, is the character of the above-mentioned representation, and it is a (generally non-holomorphic) modular form. The talk will focus on concrete classes of examples for such partition functions, discussing their mathematical properties and their dependence on geometric data (moduli), without assuming any background knowledge from CFT.