

# $\mathbb{N}^3$ -Days IX

Centre for Mathematical Sciences, Lund University  
Nov 30 - Dec 1, 2018



Organisers: Oscar Marmon, Fabien Pazuki (Copenhagen), Tomas Persson

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Friday 13:20-14:10

Tim Browning (IST Austria/Bristol)

*Free rational curves and the circle method.*

Abstract: We use a function field version of the Hardy-Littlewood circle method to study the locus of free rational curves on an arbitrary smooth projective hypersurface of sufficiently low degree. On the one hand this allows us to bound the dimension of the singular locus of the moduli space of rational curves on such hypersurfaces and, on the other hand, it sheds light on Peyre's reformulation of the Batyrev-Manin conjecture in terms of slopes with respect to the tangent bundle. This is joint work with Will Sawin.

Friday 14:20-15:10

Sara Checcoli (Grenoble)

*Fields of algebraic numbers with non-uniformly bounded local degrees and their Galois groups.*

Abstract: It is known that, if  $K$  is a number field and  $L/K$  is an infinite Galois extension, then the local degrees of  $L$  are uniformly bounded at all rational primes if and only if the group  $\text{Gal}(L/K)$  has finite exponent. Also motivated by some problems concerning the Bogomolov property (on the existence of a lower bound for the elements of non-zero height in a field), one can ask whether the simple non-uniform boundedness of the local degrees of  $L$  is still equivalent to some (weaker) group theoretical property of  $\text{Gal}(L/K)$ . We will show that this is not the case in general, by exhibiting several groups that admit two different realisations over a given number field, one with bounded local degrees at a given set of primes and one with infinite local degrees at the same primes.

Friday 15:40-16:30

Paloma Bengoechea (ETH Zürich)

*Periods of modular functions and diophantine approximation.*

Abstract: For a real quadratic irrationality  $w$  and the classical Klein's modular invariant  $j$ , the "value"  $j(w)$  has been recently defined using the period of  $j$  along the closed geodesic associated to  $w$  in the hyperbolic plane. Works of Duke, Imamoglu, Toth, and Masri establish analogies between these values and singular moduli when they are both gathered in traces. However, the arithmetic/algebraic properties of the individual values  $j(w)$  remain inaccessible. In this talk, we will address a conjecture of Kaneko on bounds for these values. Our strategy consists in studying the values  $j(w)$  according to the diophantine properties of  $w$ . This is joint work with O. Imamoglu.

Friday 16:40-17:30

Kristian Seip (Trondheim)

*Extreme values of the Riemann zeta function and its argument.*

Abstract: It is of central importance in the theory of the Riemann zeta function  $\zeta(s)$  to have as precise information as possible about the size of  $\zeta(1/2 + it)$  and its argument. I will present lower estimates for the growth of these two functions, giving the first improvement of the order magnitude since 1977. The talk is based on joint work with Andriy Bondarenko.

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Saturday 09:00-09:50

Daniel Larsson (U. of Southeast Norway)

*A noncommutative algebraic-geometric structure on rings of integers .*

Abstract: We will explain a way, using noncommutative deformation theory, of constructing noncommutative “structure sheaves” on the rings of integers in number fields. These structure sheaves turn out to encode (wild) ramification in Galois extensions. There are two different (but intimately related) versions of this construction, having slightly different starting philosophies: one is differential/infinitesimal in nature, the other is Galois-theoretic.

Saturday 10:00-10:50

Julien Roques (Lyon)

*Hypergeometric mirror maps.*

Abstract: Mirror maps are power series which occur in Mirror Symmetry as the inverse for composition of power series of the form  $q(z) = \exp(\omega_2(z)/\omega_1(z))$ , called canonical coordinates, where  $\omega_1(z)$  and  $\omega_2(z)$  are particular solutions of the Picard-Fuchs equation associated with certain one-parameter families of Calabi-Yau varieties. It has been observed that such mirror maps and canonical coordinates have integral Taylor coefficients. We will review the integrality properties of such mirror maps in the case where the differential in question is hypergeometric.

Saturday 11:20-12:10

Damaris Schindler (Utrecht)

*On prime values of binary quadratic forms with a thin variable.*

Abstract: A result of Fouvry and Iwaniec states that there are infinitely many primes of the form  $x^2 + y^2$  where  $y$  is a prime number. In this talk we will see a generalization of this theorem to the situation of an arbitrary primitive positive definite binary quadratic form. This is joint work with Peter Cho-Ho Lam and Stanley Xiao.

Saturday 12:20-13:10

Antoine Chambert-Loir (Paris 7)

*A non-archimedean Ax-Lindemann theorem.*

Abstract: A significant step in the Pila-Zannier approach to the André-Oort conjecture is a geometric transcendence result for the uniformization map of modular curves. I will discuss joint work with François Loeser. We prove an analogue of this result in non-archimedean geometry, namely for the uniformization of Mumford curves whose associated fundamental groups are non-abelian Schottky subgroups of  $\mathrm{PGL}(2, \overline{\mathbf{Q}}_p)$  contained in  $\mathrm{PGL}(2, \overline{\mathbf{Q}})$ . In particular, we characterize bi-algebraic irreducible subvarieties of the uniformization.