N-cube days XI (Gothenburg 15-16 November 2019)

Schedule

Friday

13.00 - 13.30	**Registration**
13.30 - 13.35	**Welcome**
13.35 - 14.25	**Jean-Benoît Bost**
14.35 - 15.25	**Lola Thompson**
	Fika
16.10 - 17.00	**Fredrik Strömberg**
17.10 - 18.00	**Tim Dokchitser**

In the evening we will eat at Heaven 23, at 20.00, not far from Panorama hotel. For those of you who want to walk from the math department, we will leave from outside of the conference room at 19.20. The group will pass by Panorama at about 19.40 where you can also join us. You can of course go directly to Heaven 23 if you know the way.

Saturday

09.00 – 09.50	**Joni Teräväinen**
10.00 – 10.50	**Linda Frey**
	Fika
11.20 – 12.10	**Özlem Imamoglu**
12.20 – 13.10	**Lars Halvard Halle**

Friday

Jean-Benoît Bost

Arithmetic mod-affine schemes

This talk will introduce some counterparts of affine schemes in the framework of Arakelov geometry. Their study relies on a formalism of ”nuclear quasi-coherent sheaves on arithmetic curves”, based on non-trivial estimates on the theta functions associated to Euclidean lattices and to their infinite dimensional generalizations. This formalism allows one to develop foundational results in Arakelov geometry in a manner much closer to the classical geometry of schemes than the classical approaches to Arakelov geometry, notably by avoiding properness or regularity assumptions and by permitting to transfer cohomological techniques. It also admits various «concrete applications » to Diophantine geometry, which I plan to discuss. This is joint work with François Charles.

Lola Thompson

Counting quaternion algebras, with applications to spectral geometry

We discuss how classical techniques from analytic number theory can be used to count quaternion algebras over number fields subject to various constraints. Because of the correspondence between maximal subfields of quaternion algebras and geodesics on arithmetic hyperbolic manifolds, these counts have interesting applications to the field of spectral geometry. We will conclude by describing how the breakthrough work of Maynard and Tao on bounded gaps between primes can be useful in a geometric setting. This talk is based on joint work with B. Linowitz, D. B. McReynolds, and P. Pollack.

Fredrik Strömberg

Noncongruence subgroups and Maass forms

I will present recent theoretical and computational results regarding spectral theory and Maass waveforms for non-congruence subgroups of the modular group. In particular, I will discuss spectral counting functions and Weyl laws and also present a new interpretation of old- and newforms which naturally extends the classical notions for congruence subgroups.

Tim Dokchitser

Models of curves

I would like to explain how to construct regular models and study invariants of families of curves using Newton polygons. Basically, for ‘generic’ families Ct: ft(x,y) = 0 this gives criteria for the reduction of C and describes its differentials, regular model, and etale cohomology. For elliptic curves this essentially recovers Tate’s algorithm.

Saturday

Joni Teräväinen

Chowla's conjecture at almost all scales

An unsolved conjecture of Chowla states that the Möbius function should not correlate with its own shifts. This can be viewed as a conjecture about the randomness of the Möbius function.

In the last few years, there has been a lot of progress on Chowla's conjecture. Nearly all of the previously obtained results have concerned correlations that are weighted logarithmically, so one wonders whether it is possible to get rid of these weights. We show that one can indeed remove logarithmic weights from previously known results on Chowla's conjecture, provided that one restricts to almost all scales in a suitable sense.

This is joint work with Terry Tao.

Linda Frey

Invariants of Hyperelliptic Curves of Genus Two with Complex Multiplication

Elliptic curves (genus one) can be classified by the j-invariant about which we know a lot. A result from 2018 of Bilu, Habegger and Kühne states that there are no j-invariants of elliptic curves with complex multiplication that are algebraic units. In the genus two case it gets more complicated. We have a tuple of three invariants which almost classify the genus two curves. We call them Igusa invariants. But not much is known about of the curve has complex multiplication whether the Igusa invariants are algebraic integers or even units. We will compare the two cases (genus one and two), state some conjectures and outline some approaches.

Özlem Imamoglu

On class number formulas

Dirichlet’s class number formula for binary quadratic forms is well known. In a mostly forgotten paper Hurwitz gave another infinite series representation for the class number of positive definite quadratic forms. In this talk I will give a proof of Hurwitz’s formula and show how it can be generalized to indefinite case.

Lars Halvard Halle

Arithmetic Geometry of Crauder-Morrison Models for K3 Surfaces

Kodaira's classification of degenerate fibers in elliptic fibrations is a very useful tool in the study of elliptic curves, with a wealth of applications both in geometry and in number theory. In the context of K3 surfaces, there exists a partial classification of degenerate fibers, due to Crauder and Morrison. In this talk, I will explain how Crauder and Morrison's theory, when applicable, can be used to investigate some natural questions and invariants, such as: existence of logarithmic good reduction, the index, the motivic zeta function and the monodromy.