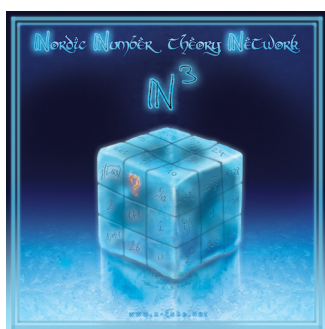# ℕ-cube days V

Chalmers University of Technology and University of Gothenburg

November 25-26, 2016

UNIVERSITY OF
GOTHENBURG

CHALMERS

PROGRAMME

Location: Euler

TIME	Friday 25th
13:15 − 14:05	**Hesselholt**
14:15 − 15:15	**Kowalski**
15:15 − 15:45	Coffee Break
15:45 − 16:35	**Viazovska**
16:45 − 17:35	**Li**
19:00	Social Dinner

TIME	Saturday 26th
09:00 − 09:50	**Tanimoto**
09:55 − 10:45	**Derenthal**
10:45 − 11:10	Coffee Break
11:10 − 12:00	**Myerson**
12:05 − 12:55	**Van Order**

Abstracts

Time: Saturday 26th, 09:55
Speaker: **Ulrich Derenthal** (Leibniz-Universität Hannover)
Title: Manin's conjecture for some spherical threefolds
Abstract: Manin's conjecture predicts the asymptotic behavior of the number of rational points of bounded height on Fano varieties. Spherical varieties admit a combinatorial description by Luna data and colored fans. In this talk, we discuss Manin's conjecture for some singular spherical threefolds. Its rational points are counted via universal torsors, which can be explicitly described using Brion's work on Cox rings of spherical varieties. This is joint work with Giuliano Gagliardi.

Time: Friday 25th, 13:15
Speaker: **Lars Hesselholt** (University of Copenhagen)
Title: Topological Hochschild homology and the Hasse-Weil zeta function
Abstract: In the nineties, Deninger gave a detailed description of a conjectural cohomological interpretation of the (completed) Hasse-Weil zeta function of a regular scheme proper over the ring of rational integers. He envisioned the cohomology theory to take values in countably infinite dimensional complex vector spaces and the zeta function to emerge as the regularized determinant of the infinitesimal generator of a Frobenius flow. In this talk, I will explain that for a scheme smooth and proper over a finite field, the desired cohomology theory naturally appears from the Tate cohomology of the action by the circle group on Bökstedt's topological Hochschild homology of the scheme in question.

Time: Friday 25th, 14:15
Speaker: **Emmanuel Kowalski** (ETH Zürich)
Title: A geometric interpretation of some additive problems for primes
Abstract: The talk will describe how the function field version of some additive problems for primes, such as the Schinzel Hypothesis, can be formulated in a geometric way. We will then discuss some progress in solving these geometric questions, and present some further questions and analogies that arise from this point of view..

Time: Friday 25th, 16:45
Speaker: **Yingkun Li** (Universität Darmstadt)
Title: Title: Harmonic Maass forms associated to real quadratic field
Abstract: Classically, definite quadratic forms give rise to theta series, which are holomorphic modular forms. In 1926, Hecke attached weight one holomorphic theta series to indefinite quadratic forms of signature $(1, 1)$. The construction is ingenious and the calculations reminds one of the Rankin-Selberg unfolding method, which appeared 10 years later. In 2003, Bruinier and Funke introduced the notion of harmonic Maass forms, which have poles and map to classical holomorphic modular forms under a suitable differential operator. In this talk, we will construct harmonic Maass forms of weight one that map to Hecke's indefinite theta series, and study their Fourier coefficients. This is a joint work with Pierre Charollois.

Time: Saturday 26th, 11:10
Speaker: **Simon Rydin Myerson** (University College London)
Title: Real and rational systems of forms
Abstract: Consider a system f of R forms of degree d, with integral coefficients, in n variables. A classic result of Birch estimates the density of integral zeroes of f when $n \gg_d R^2$ is large and the variety $f = 0$ is smooth. When $d = 2$ or 3, we weaken the condition on n to $n \gg_d R$, and give a version for systems of Diophantine inequalities $|f| < 1$ with real coefficients. Our strategy reduces the problem to an upper bound for the number of solutions to a multilinear auxiliary inequality. We discuss extensions to higher degrees.

Time: Saturday 26th, 09:00
Speaker: **Sho Tanimoto** (University of Copenhagen)
Title: Exceptional sets in Manin's conjecture
Abstract: Manin's conjecture predicts the asymptotic formula for the counting function of rational points on a Fano variety after removing contributions from an exceptional set. In this talk, I will discuss the birational geometry of this exceptional set using the minimal model program. This is joint work with Brian Lehmann..

Time: Saturday 26th, 12:05
Speaker: **Jeanine Van Order** (Universität Bielefeld)
Title: Average values of GL(n)-automorphic L-functions
Abstract: I will explain what is known and what is conjectured about GL(n)-automorphic L-functions twisted by Dirichlet characters within the centre of the critical strip, with emphasis on cohomological representations and relations to standard conjectures. I will then explain how the setting of Dirichlet characters of prime-power modulus can be used to obtain a more explicit handle on the problem, and for instance how the Voronoi summation formula can be used to obtain estimates in at least in some cases.

Time: Friday 25th, 15:45
Speaker: **Maryna Viazovska** (Freie Universität Berlin)
Title: The sphere packing problem in dimensions 8 and 24
Abstract: The sphere packing problem is to find an arrangement of non-overlapping unit spheres in the d-dimensional Euclidean space in which the spheres fill as large a proportion of the space as possible. In this talk we will present a solution of the sphere packing problem in dimensions 8 and 24. In 2003 N. Elkies and H. Cohn proved that the existence of a real function satisfying certain constrains leads to an upper bound for the sphere packing constant. Using this method they obtained almost sharp estimates in dimensions 8 and 24. We will show that functions providing exact bounds can be constructed explicitly as certain integral transforms of modular forms. Therefore, the sphere packing problem in dimensions 8 and 24 is solved by a linear programming method.