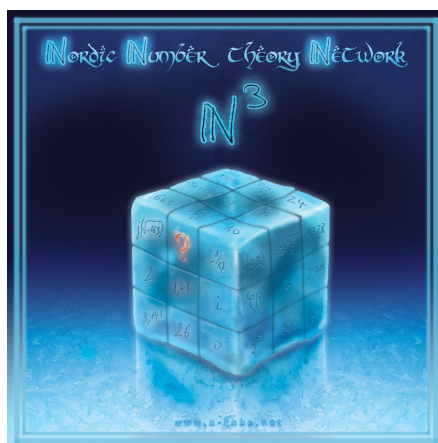# Toric and Arithmetic Day 2024

University of Copenhagen,
June 5, 2024
organised by Fabien Pazuki.

Program

	June 5 in Aud 9
10:00-10:50	**Máté László Telek**
11:00-11:50	**Qingyuan Bai**
12:00-13:00	*Lunch*
13:00-13:50	**Nuno Hultberg**
14:00-14:50	**Yunqing Tang**
15:00-16:00	*Coffee break*
19:00	*Dinner*

Abstracts

Time: June 5, 10:00-10:50.
Speaker: **Máté László Telek** (University of Copenhagen, Denmark).
Title: *Signed support of multivariate polynomials and Descartes' rule of signs.*

Abstract: The classical Descartes' rule of signs provides an easily computable upper bound for the number of positive real roots of a univariate polynomial with real coefficients. Descartes' rule of signs is of special importance in applications where positive solutions to polynomial systems are the object of study. This is the case in reaction network theory where variables are concentrations or abundances. Motivated by this setting, we give conditions based on the geometrical configuration of the exponents and the sign of the coefficients of a polynomial that guarantee that the number of connected components of the complement of the hypersurface where the defining polynomial attains a negative value is at most one or two. Furthermore, we discuss conditions on the signed support that provide lower or upper bounds on the number of positive solutions of parametrized polynomial equation systems.

Time: June 5, 11:00-11:50.
Speaker: **Qingyuan Bai** (University of Copenhagen, Denmark).
Title: *Revisiting coherent-constructible correspondence.*

Abstract: This talk is about the coherent-constructible correspondence of Fang-Liu-Treumann-Zaslow. The main goal is to explain the construction of the functor along with symmetric monoidal structure, and indicate how it lifts to the setting of spectral algebraic geometry. I will then end with a speculation. This is joint with Yuxuan Hu from Northwestern University.

Time: June 5, 13:00-13:50.
Speaker: **Nuno Hultberg** (University of Copenhagen, Denmark).
Title: *Arakelov geometry of semiabelian varieties and toric bundles.*

Abstract: The talk will start out by introducing some basics of Arakelov geometry and heights. Contrary to canonical heights on abelian varieties or toric varieties, heights on semiabelian varieties and their compactifications do not arise from a polarized dynamical system. Small points on semiabelian varieties are therefore more mysterious than in the previous cases. We place the case of semiabelian varieties in the context of toric bundles and study arithmetic invariants of semiabelian varieties from this point of view.

Time: June 5, 14:00-14:50.
Speaker: **Yunqing Tang** (UC Berkeley, USA).
Title: *The arithmetic of power series and applications.*

Abstract: Borel and Dwork gave conditions on when a nice power series with rational number coefficients comes from a rational function in terms of meromorphic convergence radii at all places. Such a criterion was used in Dwork's proof of the rationality of zeta functions of varieties over finite fields. Later, the work of André, Bost, Charles and many others generalized the rationality criterion of Dwork and deduced many applications in the arithmetic of differential equations and elliptic curves. In this talk, we will discuss some further refinements and generalizations of the criteria of André, Bost, and Charles and their applications to modular forms and irrationality of certain periods. This is joint work with Frank Calegari and Vesselin Dimitrov.