Abstracts

Kaveh Mousavand, **Applications of Tropical Geometry in Cluster Algebras**

In the development of cluster algebras, as a young and active area of research introduced by Fomin and Zelevinsky in early 2000's, tropical geometry has played a significant role. In this talk, after a quick review of the rudiments of cluster algebras, we focus on the choice of the semi-field in the construction of clusters, where tropical geometry is used, and we show how the change of the semifield reflects in the cluster algebra structures.

Reimi Irokawa, **Activity measures of dynamical systems over non-archimedean fields.**

Toward the understanding of bifurcation phenomena of dynamics on the Berkovich projective line $\mathbb{P}^{1,an}$ over non-archimedean fields, we studied the stability (or passivity) of critical points of families of polynomials parametrized by an analytic curve. We constructed the activity measure of a critical points of a family of polynomials, and studied its property : equidistribution, relation to the Mandelbrot set.

Alheydis Geiger, **Realisability of infinite families of tropical lines on general smooth tropical cubic surfaces**

A tropical line on a smooth tropical cubic surface can be realised, if there exists a line on a smooth cubic surface, such that the tropicalisation of the surface and the line coincide with the given tropical cubic surface and tropical line. The tropical lines on a smooth tropical cubic surface can be classified by their combinatorial position. Thus we can distinguish isolated lines and two-point families. The latter are infinite families of tropical lines on the same surface of the same combinatorial position. There are two combinatorial positions of lines of general smooth tropical cubic surfaces that allow infinite families. The question is, whether all the lines in these families can be realised on some lift of the tropical cubic surface. This problem is only solved for one of the two positions and I will present the solution. If there is still time I can make a detour to the second family and the problems in solving this case.

Roberto Gualdi, **Higher dimensional essential minima and equidistribution of subvarieties**

Equidistribution results in Arakelov geometry are an instance of the strong interconnection between geometry and arithmetic. For example, they control the geometric behaviour of a sequence of points of small height in all the analytifications of a projective variety X defined over a number field or a function field. In this kind of statements, the *essential minimum* of X with respect to a choice of a metrized line bundle plays a fundamental role.
In an ongoing work with César Martínez, for all $d \in \{0, \ldots, \dim(X)\}$ we propose a definition for a d-dimensional analogue of such an arithmetic invariant. We provide for it inequalities close to Zhang's classical ones and we clarify its relation with the equidistribution of d-dimensional small subvarieties.

Paul Helminck, **Nonarchimedean decompositions of fundamental groups of curves**

For tame coverings of a curve, there is a natural tropicalization functor to the category of tame coverings of a metrized complex associated to the curve. By enhancing the latter category with some extra data, we can then obtain an equivalence of categories, yielding a natural notion of a tropical fundamental group for curves. This then gives natural decompositions of the original fundamental group by considering the tropically étale and completely split cases. The abelianizations of these subgroups can then be linked to subgroups of the Néron model of the Jacobian of the curve and we will give a proof of this using the Poincaré-Lelong formula.

Vlerë Mehmeti, **A Local-Global Principle over Berkovich Curves**

Abstract: Patching is a method first used as an approach to the Inverse Galois Problem. The technique was then extended to a more algebraic setting and used to prove a local-global principle by D. Harbater, J. Hartmann and D. Krashen. I will present an adaptation of patching to the setting of Berkovich analytic curves. This will then be used to prove a local-global principle (applicable to quadratic forms) for function fields of curves that generalizes that of the above mentioned authors.

Ben Smith, **Convergent Puiseux series and tropical geometry of higher rank**

Tropical hypersurfaces arising from polynomials over the Puiseux series are well studied and well understood objects. The picture becomes less clear when considering Puiseux series in multiple indeterminates. Unlike their rank one counterparts, these higher rank tropical hypersurfaces are not ordinary polyhedral complexes, but we shall see they still have a large amount of structure. Moreover, by restricting to convergent Puiseux series we show how one can describe them via the rank one tropical hypersurfaces arising from substitution of indeterminates. We will also consider a couple of applications of this framework, including a new viewpoint for stable intersection in the vein of symbolic perturbation.

Leo Herr, **The Log Product Formula**

Log structures are a universal way to compactify schemes. As such, they treat mildly singular spaces such as "+" as if they were smooth. They have been successfully applied to compactifying moduli spaces of D-modules, Hodge Structures, Connections, K3 Surfaces, Algebraic Differential Equations, Abelian Varieties, etc. We will focus on applying them to Gromov-Witten Invariants and Curve counting. We present foundational results towards a future "Log Intersection Theory" and offer a sample computation of Log Gromov-Witten Invariants of a Product.

Trevor Gunn, **Constructing faithful tropicalizations for Mumford curves in $\mathbb{P}^3$**

By considering piecewise-linear functions on a metric graph, we can construct tropical curves. Applying this to skeleta of non-Archimedean curves, and using a suitable lifting theorem of Jell, we can construct tropicalizations of the non-Archimedean curves. We will exhibit this technique in a few small cases and (time-permitting) explain a general construction that allows us to find faithful tropicalizations in tropical $\mathbb{P}^3$. This is joint work with Philipp Jell.

Hongming Nie, **Indeterminacy loci of iterate maps in moduli space**

The moduli space rat_d of rational maps in one complex variable of degree $d \geq 2$ has a natural compactification by a projective variety $\overline{\mathrm{rat}}_d$ provided by geometric invariant theory. Given $n \geq 2$, the iteration map $\Phi_n : \mathrm{rat}_d \to \mathrm{rat}_{d^n}$, defined by $\Phi_n : [f] \mapsto [f^n]$, extends to a rational map $\Phi_n : \overline{\mathrm{rat}}_d \dashrightarrow \overline{\mathrm{rat}}_{d^n}$. With Berkovich dynamics, we characterize the elements of $\overline{\mathrm{rat}}_d$ which lie in the indeterminacy locus of Φ_n. This is a joint work with J. Kiwi.

Madeline Brandt, **Symmetric powers of algebraic and tropical curves**

Recently, tropical geometry has emerged as a tool for studying classical moduli spaces by associating to every variety a polyhedral complex which comes as its non-Archimedean skeleton. Classically, it is known that the d-th symmetric power of a smooth, projective algebraic curve X is again a smooth, projective algebraic variety which functions as the moduli space of effective divisors of degree d on X. In this talk, I will discuss two ways to tropicalize this statement. The first way is to take the d-th symmetric power of the tropicalization of X, and the second is to tropicalize the d-th symmetric power of X itself. In recent work with Martin Ulirsch, we show that in fact the two agree. I will present all necessary definitions for understanding the above statement and I will sketch the proof.

Tim Gabele, **Tropical correspondence for the log Calabi-Yau pair ($\mathbb{P}^2$,E)**

$\mathbb{P}^2$ together with an elliptic curve E forms a log Calabi-Yau pair ($\mathbb{P}^2$,E). As part of my thesis I show that the structure used to define a toric degeneration of the mirror of ($\mathbb{P}^2$,E) via the Gross-Siebert reconstruction algorithm contains enumerative data of ($\mathbb{P}^2$,E): Attached to the walls of the structure, there are functions describing the non-toric automorphisms which are necessary for a well-defined gluing of toric models. I show that for unbounded walls, the logarithm of these functions gives a generating series for logarithmic Gromov-Witten invariants of $\mathbb{P}^2$ with maximal tangency condition to E at a single point. This can be seen as a tropical correspondece theorem for ($\mathbb{P}^2$,E). It extends work of Gross-Pandharipande-Siebert on toric varieties with toric boundary divisors.

Yuki Tsutsui, **Radiance obstructions of tropical Kummer surfaces**

Integral affine manifolds with singularities were studied by Gross and Siebert for the study of mirror symmetry. In this presentation, we study tropical Kummer surfaces as an integral affine manifold with singularities and compute its radiance obstruction. We also discuss about tropical analogues of the period map of the Kummer surface associated with a complex 2-torus.

Samouil Molcho, **Tropical Moduli Problems**

In recent years, logarithmic geometry has been used to compactify several important moduli spaces that appear in algebraic geometry. Starting with a moduli space of some class of smooth objects, one considers the associated "log" moduli space, which parametrizes the same class of log smooth objects instead. This space is typically automatically proper and enjoys a number of excellent formal properties. The log moduli space can in turn be studied through its tropicalization. One of the interesting phenomena that has been observed in numerous examples is that the tropicalization itself can be interpreted as a moduli space, parametrizing some class of tropical objects determined from the original moduli space. In this talk I would like to discuss some examples of this phenomenon, and the tropical moduli problems that arise this way. Time permitting, I will discuss the examples of nodal curves, stable maps, and the Picard variety.

Kalina Mincheva, **Prime tropical ideals**

Tropical geometry provides a new set of purely combinatorial tools, which has been used to approach classical problems. In tropical geometry most algebraic computations are done on the classical side - using the algebra of the original variety. The theory developed so far has explored the geometric aspect of tropical varieties as opposed to the underlying (semiring) algebra and there are still many commutative algebra tools and notions without a tropical analogue. In the recent years, there has been a lot of effort dedicated to developing the necessary tools for commutative algebra using different frameworks, among which prime congruences, tropical ideals, tropical schemes. These approaches allows for the exploration of the properties of tropicalized spaces without tying them up to the original varieties and working with geometric structures inherently defined in characteristic one (that is, additively idempotent) semifields. In this talk we explore the relationship between tropical ideals and congruences to conclude that the variety of a prime tropical ideal is either empty or consists of a single point. This is joint work with D. Joó.