

Fall 2025

▪ **August 26**

Speaker: NA

Title: Organizational Meeting

Abstract:

▪ **September 9**

Speaker: Huy Dang (Binghamton)

Title: The lifting problem for curves

Abstract: The lifting problem for curves asks: given a smooth, projective, connected curve C over a field k of characteristic $p > 0$, which finite Galois coverings of C lift to characteristic zero? In this talk, we provide an overview of the central questions and techniques used to study this problem. We will also discuss connections with other areas of research, including deformation theory and ramification theory.

▪ **September 16**

Speaker: Huy Dang (Binghamton)

Title: Lifting abelian isogenies from characteristic p to characteristic 0

Abstract: In characteristic 0 , cyclic field extensions are classified by Kummer theory. In characteristic p , in addition to Kummer theory, one also needs Artin-Schreier-Witt theory to describe these extensions. Matsuda constructed a formal morphism that connects these two theories, providing a bridge between characteristic p and characteristic 0 . In this talk, we present an algebraization of Matsuda's construction to study the lifting of abelian isogenies from characteristic p to characteristic 0 . As an application, we show that every lift of an abelian étale cover of a local scheme arises as the pullback of such a lift of an abelian isogeny. This is joint work with Khai-Hoan Nguyen-Dang.

▪ **September 30**

Speaker: Enrique Trevino (Lake Forest College)

Title: On sets whose subsets have integer mean

Abstract: We say a finite set of positive integers is balanced if all of its subsets have integer mean. For a positive integer N , let $M(N)$ be the cardinality of the largest balanced set all of whose elements are less than or equal to N , and let $S(N)$ be the cardinality of the largest balanced set with elements less than or equal to N that has maximal sum. For example, for $N = 3000$, the largest balanced set is $\{3000, 2580, 2160, 1740, 1320, 980, 480, 60\}$ so $M(3000) = 8$, while the largest set with maximal sum is $\{3000, 2940, 2880, 2820, 2760, 2700, 2640\}$, so $S(3000) = 7$. In this talk we will study the question of when $M(N) = S(N)$.

▪ **October 16 (Thursday, 2:45-3:45 pm, cross-listed from Geometry and Topology Seminar)**

Speaker: John Abou-Rached (Binghamton)

Title: Integral models for non-Shimura curves and the Eichler-Shimura congruence relation

Abstract: We construct integral models for an infinite family of algebraic curves that includes noncongruence modular curves, as well as curves whose uniformizers are non-arithmetic Fuchsian groups. Most of these curves are not Shimura curves. We affirm a conjecture of Mukamel that the set of primes of good reduction of such curves have arithmetic significance and obtain an explicit description of this set. We conjecture that a version of Deligne-Rapoport's study of the reduction of modular curves holds in this context, and conjecture that a version of the Eichler-Shimura congruence relation holds in this setting, in resonance with Shimura curves.

▪ **October 21**

Speaker: Alexander Borisov

Title: A structure sheaf for Kirch topology on \mathbb{N}

Abstract: Kirch topology on \mathbb{N} goes back to a 1969 paper of Kirch. It can be defined by a basis of open sets that consists of all infinite arithmetic progressions $a+d\mathbb{N}_0$, such that $\gcd(a,d)=1$ and d is square-free. It is Hausdorff, connected, and locally connected. One can hope that in the classical imperfect analogy between arithmetic and geometry this can serve as an arithmetic analog of the usual topology on \mathbb{C} . However, the usual topology on \mathbb{C} comes with a structure sheaf of complex-analytic functions. As far as I know, no analog for Kirch topology has been proposed before me. I believe that I have stumbled upon just such a thing, more by accident than by a conscious effort: locally LIP functions. These are functions from Kirch-open sets to \mathbb{Z} such that for every point in the domain there is a Kirch-open neighborhood on which the function is “locally integer polynomial” (LIP): its interpolation polynomial on every finite set has integer coefficients. I will explain why this seems to be a natural object, what I know about it and what I hope to achieve. Some of the material of this talk will be based on my recently published paper: <https://math.colgate.edu/~integers/z41/z41.pdf>

▪ November 4

Speaker: Bhargavi Parthasarathy (Syracuse University)

Title: Homomorphisms of maximal Cohen-Macaulay modules over the cone of an elliptic curve

Abstract: Consider the ring $R=k[[x,y,z]]/(f)$ where $f=x^3+y^3+z^3$ with an algebraically closed field k and $\text{char}(k)\neq 3$. In a 2002 paper, Laza, Popescu and Pfister used Atiyah’s classification of vector bundles over elliptic curves to obtain a description of the maximal Cohen-Macaulay modules (MCM) over R . In particular, the matrix factorizations corresponding to rank one MCMs can be described using points in $V(f)$. If M, N are rank one MCMs over R , then so is $\text{Hom}_R(M,N)$. In this talk, I will discuss how the elliptic group law on $V(f)$ can be used to obtain the point in $V(f)$ that describes the matrix factorization corresponding to $\text{Hom}_R(M,N)$.

▪ November 18 (Joint with the Combinatorics Seminar)

Speaker: Jaeho Shin (Seoul National University)

Title: Biconvex Polytopes and Tropical Linear Spaces

Abstract: Tropical geometry is geometry over exponents of algebraic expressions, using the “logarithmized” operations $(\min,+)$ or $(\max,+)$. In this setting, one can define tropical convexity and the related notion of biconvex polytopes, which are convex both classically and tropically. There is also a tropical analogue of linear spaces, called tropical linear spaces. Sturmfels conjectured that every biconvex polytope arises as a cell of a tropical linear space. In this talk, I will outline a proof of this conjecture.

▪ December 2

Speaker: Bogdan Ion (University of Pittsburgh)

Title: Bernoulli operators, Dirichlet series, and analytic continuation

Abstract: Bernoulli operators are distributions with discrete support associated to Dirichlet series (or rather to the corresponding power series). The most basic case, when the power series has a pole singularity at $z=1$ is analyzed in detail. Its main property is that it naturally acts on the vector space of analytic functions in the plane (with possible isolated singularities) that fall in the image of the Laplace-Mellin transform (for the variable in some half-plane). The action of the Bernoulli operator on the function t^s , provides the analytic continuation of the associated Dirichlet series and also detailed information about the location of poles, their residues, and special values. Using examples of arithmetic origin, I will attempt to illustrate what is reasonable to expect when the power series has a non-pole singularity at $z=1$, pointing to an extension of this theory to tempered distributions associated to modular forms.

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