Conference Programme and Abstracts

Early-Career Mathematicians in the Balkans
12–13 December 2025

Friday, 12 December

10:00 – 11:00
Christelle Kozaily (IMI–BAS, Sofia)
On Q-matricity.
Abstract: This talk explores the geometric foundations of linear complementarity theory, with a focus on the challenging problem of finding a satisfactory characterization of Q-matricity. This notion is closely linked to the existence of solutions for Linear Complementarity Problems (LCPs) and their system counterpart, Linear Complementarity Systems (LCSs). At the core lies a geometric question: whether the Euclidean space can be covered by a finite collection of structured closed convex cones. This perspective suggests promising directions for deepening our understanding of Q-matricity.

11:00 – 12:00
Miroslav Maksimović (IMI–BAS, Sofia)
Semi-symmetric metric connection, concircular generator and the theory of relativity.
Abstract: In this lecture, we will talk about a semi-symmetric metric connection whose generator is a concircular vector field, i.e. the so-called concircularly semi-symmetric metric connection. Since six linearly independent curvature tensors can be observed with respect to any non-symmetric connection, we will first give the properties of these tensors in a pseudo-Riemannian manifold. After that, we will deal with the application of the results to Lorentzian manifolds and to the theory of relativity. In this way, we can arrive at the GRW space-time and to the perfect fluid space-time, where we will determine the equation of state. These are the results of joint work with prof. Milan Zlatanović.

12:00 – 14:00 Lunch break

14:00 – 15:00
Diana Mocanu (Max Planck Institute, Bonn)
Local points on twists of $X(p)$***.***
Abstract: Let E be a rational elliptic curve and p an odd prime. The modular curve $X_E^-(p)$ parametrizes elliptic curves with p-torsion modules anti-symplectically isomorphic to $E[p]$. In this talk, I present my recent work with Nuno Freitas on a complete classification for when these curves admit points everywhere locally. I will end with two applications. Firstly, I will show how to construct counterexamples to Hasse's principle of the shape $X_E^-(p)$ for fixed E and infinitely many primes p. Secondly, I will present an application of the modular method together with our results to prove certain generalized Fermat equations have no non-trivial coprime solutions.

15:00 – 16:00
Lazar Radičević (Mathematical Institute, Serbian Academy of Sciences and Arts, Belgrade)
3-descent on genus 2 Jacobians using visibility.
Abstract: We show how to explicitly compute equations for everywhere locally soluble 3-coverings of Jacobians of genus 2 curves with a rational Weierstrass point, using the notion of visibility introduced by Cremona and Mazur. These 3-coverings are abelian surface torsors, embedded in the projective space $\mathbb{P}^8$ as degree 18 surfaces. They have points over every p-adic completion of $\mathbb{Q}$, but no rational points, and so are counterexamples to the Hasse principle and represent non-trivial elements of the 3-torsion part of the Tate–Shafarevich group of the Jacobian. Joint work with Tom Fisher.

16:00 – 16:30 Coffee break

16:30 – 17:30
Michał Gutowski (IMI–BAS, Sofia)
Trapping effect of stable processes.
Abstract: We are interested in the motion of a particle in a disordered medium, where the local structure of the environment induces random trapping events whose intensity depends on the particle's position. We model this phenomenon by a β-stable process subordinated by the inverse of an $\alpha(x)$-stable subordinator, where $\beta \in (1, 2]$. The resulting process is semi-Markovian. We will see that under appropriate technical assumptions on the function $\alpha(x)$, the process spends only a negligible amount of time outside a neighbourhood of the set of $\operatorname{argmin} \alpha(x)$. The work is a natural continuation of the results provided by M. Savov and B. Toaldo in *Semi-Markov processes, integro-differential equations and anomalous diffusion-aggregation*, Ann. Inst. Henri Poincaré Probab. Stat., 56(4):2640–2671, 2020.

Evening: Conference dinner

Saturday, 13 December

10:00 – 11:00
Ratko Darda (Sabancı University, Istanbul)
Batyrev–Manin conjecture and modular curves.
Abstract: The Batyrev–Manin conjecture predicts the number of rational points of bounded height on certain varieties. It asserts the existence of constants a and b such that the number of rational points of height less than B is asymptotically $CB^a \log(B)^b$ for some $C > 0$. Recently, a significant attention has been devoted to the statistical properties of level structures on elliptic curves. For instance, it has been shown that for the 15 values of N for which the modular curve $X_0(N)$ has genus 0, the number of elliptic curves defined over $\mathbb{Q}$ admitting rational cyclic N-isogeny also satisfies an asymptotic formula $CB^a \log(B)^b$. Despite the reminiscent formulas, these results do not fit in the framework of the standard Batyrev–Manin conjecture because of the presence of non-trivial isomorphisms. We explain how they can be interpreted as instances of a generalization of Batyrev–Manin conjecture to Deligne–Mumford stacks. The talk is based on a joint work with Changho Han and Mohammad Sadek.

11:00 – 12:00
Vlad Mitankin (IMI–BAS, Sofia)
Local-global principles for semi-integral points on Markoff orbifold pairs.
Abstract: In this talk we shall discuss the status of local-global principles for semi-integral points on orbifold pairs of Markoff type. If time permits, we will discuss a way to count Markoff orbifold pairs that satisfy the semi-integral Hasse principle while the corresponding Markoff surface lacks integral points. This talk is based on a joint work with Justin Uhlemann.

12:00 – 14:00 Lunch break

14:00 – 15:00
Alexandros Konstantinou (IMI–BAS, Sofia)
Ranks of elliptic curves and rank parity for Jacobians.
Abstract: Questions about rational points on elliptic curves go back to Diophantus, but the modern arithmetic theory begins with the Mordell–Weil theorem a little over one hundred years ago. In this talk I will give a light historical overview of the subject and outline some of the main developments in the field over the last century, including its role in Fermat's Last Theorem and the formulation of the Birch Swinnerton–Dyer conjecture. I will then discuss the parity conjecture, explaining how the functional equation governs the behaviour of rational points. I will conclude with recent work with Dokchitser, Green, and Morgan.

15:00 – 16:00
Andrei Bengus-Lasnier (IMI–BAS, Sofia)
From complete intersection to general curves.
Many invariants of geometric objects, such as manifolds and varieties, can be computed by induction on the codimension. If an object is defined by r equations $F_1, \ldots, F_r$, then we can compute our invariant for F_1, then for the variety defined by F_1, F_2 and so on. If each time we add an equation the dimension drops, then our variety is a complete intersection. Many formulas are given for such varieties, such as the genus–degree formula. In this talk, I will present a way to extend such a formula to general curves (reduced varieties of dimension 1, not necessarily smooth). To do so, we introduce a numerical quantity, the *complete intersection discrepancy*. It will appear as a correction factor. Time permitting I will also present applications to singularity theory.

This is a gentle introduction to a collaborative work with Antoni Rangachev and Terence Gaffney.

16:00 Closing remarks / Coffee