

Programme

Geometry and Topology in Low Dimensions: Lasting Trends and Emerging Directions

All events will take place at the Hungarian Academy of Sciences (Széchenyi István tér 9, 1051), except the optional reception on Sunday evening and the lightning talks on Thursday, which will be at the Rényi Institute (Reáltanoda utca 13-15, 1053).

Sunday

- 17:00 - 19:00

Wine and cheese reception (Rényi Institute)

Monday: Exotica

Morning

- 9:30 - 10:00

Registration (Hungarian Academy of Sciences)

1. 10:00 - 11:00

Daniel Ruberman (Brandeis University)

Panorama talk on Exotica

- 11:00 - 11:30

Coffee + pastries

- 11:30 - 11:45

Lightning talks

Ansel Goh (University of Texas at Austin):

h -cobordisms between simply connected 4-manifolds with boundary

Isacco Nonino (University of Glasgow):

Pseudo-isotopies of topological 4-manifolds

Simone Tagliente (Rényi Institute, ELTE):

Exotic 4-manifolds with $\mathbb{Z}/4k$ fundamental group

2. 11:45 - 12:45

Lisa Piccirillo (University of Texas at Austin)

Ideal broken Lefschetz fibrations

Symplectic manifolds provide an important testing ground for the smooth 4-manifold topologist; unlike their smooth counterparts, symplectic manifolds are known to satisfy some amount of structural rigidity. In this talk, we introduce a class of not-necessarily symplectic smooth 4-manifolds which admit some rigidity properties analogous to those which arise in the symplectic setting. This is joint work with Tye Lidman.

Afternoon

3. 15:00 - 16:00

Inanc Baykur (University of Massachusetts Amherst)

Exotica via symplectica

I'll discuss some of our recent work towards four dimensional exotica through algebraic relations in mapping class groups and techniques from symplectic topology.

- 16:00 - 16:30

Coffee

4. 16:30 - 17:30

Sungkyung Kang (University of Cambridge)

Exoticness of Dehn twists in dimension 4

Recently there has been a flurry of activities around exotic diffeomorphisms of smooth 4-manifolds. The central object of study are 4-dimensional Dehn twists, which is a very flexible construction that produces diffeomorphisms that are topologically isotopic to identity, i.e. potentially exotic. Remarkably, this construction is flexible enough to produce a lot of exotic diffeomorphisms. In this talk, we will discuss its history and recent developments, including its instability.

Tuesday: Symplectic Geometry

Morning

1. 9:00 - 10:00

Gordana Matić (University of Georgia)

Panorama talk on Symplectic Geometry

• 10:00 - 10:30

Coffee + pastries

• 10:30 - 10:45

Lightning talks

Márton Beke (Rényi Institute, BME):

An unexpected rational blowdown

Nancy Mae Eagles (University of California, Berkeley):

Invariants of Legendrians in thickened convex surfaces

Hanming Liu (University of Oregon):

Partially wrapped contact Fukaya categories of 1-jet spaces

2. 10:45 - 11:45

Laura Starkston (UC Davis)

Sandwiched singularities, symplectic fillings, braided planar surfaces, and wiring diagrams

We will talk about how to construct and classify symplectic fillings for links of certain complex surface singularities utilizing surfaces in $\mathbb{C}^2$. This is inspired by work of de Jong and van Straten in the complex deformation theory setting, and uses nearly Lefschetz fibrations to bring this theory into the symplectic setting. Encoding surfaces in $\mathbb{C}^2$ can be done via wiring diagrams, which in turn gives us a concrete way to construct symplectic fillings. In particular, it allows us to find new rational homology disk symplectic fillings of singularity links. This is based on two articles one which is joint with Plamenevskaya and the other is joint with Beke and Plamenevskaya.

3. 12:00 - 13:00

Luya Wang (Princeton University and Institute for Advanced Study)

Complements of submanifolds in 4-dimensional Weinstein domains

I will introduce the notion of nearly Lefschetz fibrations, which can be viewed as the complements of neighborhoods of positive multisections in bordered Lefschetz fibrations. We show that these objects are supported by canonical Stein structures and provide a tool to understand Lagrangian submanifolds in Weinstein domains. In particular, we show that in 4-dimensional Weinstein domains, all exact Lagrangian disks with Legendrian boundaries are regular, in the sense of Eliashberg-Ganatra-Lazarev. This is joint work in progress with Agniva Roy and Joseph Breen.

Afternoon

4. 15:00 - 16:00

MARCO GOLLA (University of Nantes)

Topological (non-)realisability of line arrangements

In 1983, Hirzebruch proved a beautiful inequality giving strong restrictions on the combinatorics of complex line arrangements in $\mathbb{CP}^2$. In the quest for a topological proof of this inequality, we studied certain combinatorial types of line arrangements (which we call odd, even, and divisible), for which we proved some Hirzebruch-like inequalities. If time permits, I will discuss some more speculative ideas on similar and related questions. This is partly based on joint work with Paolo Aceto.

• 16:00 - 16:30

Group photo

• 16:30 - 17:00

Coffee

5. 17:00 - 18:00

Andrew Lobb (University of Durham)

Recent progress in peg problems

So-called peg problems ask whether curves in the plane contain certain configurations of points. The classical, unsolved, example is the Toeplitz Square Peg Problem which asks whether every Jordan curve contains four points at the vertices of a square. We shall give an overview of recent progress on peg problems using the tools of symplectic geometry. We shall mention work by the speaker in collaboration with Josh Greene, as well as work by Asano-Ike, Barber, Hugelmeyer, and Naseri Sadr.

Wednesday: Heegaard Floer homology

Morning

1. 9:00 - 10:00

Peter Ozsváth (Princeton University)

Panorama talk on Heegaard Floer homology

• 10:00 - 10:30

Coffee + pastries

• 10:30 - 10:45

Lightning talks

Alberto Cavallo:

Heegaard Floer homology and maximal twisting numbers

Patricia Sorya (University of Ottawa):

Persistence modules and ribbon concordance

Hongyi Zhou (University of Michigan):

Unknotting number and L-space satellite operators

2. 10:45 - 11:45

Adam Levine (Duke University)

Knot Floer homology, bordered Floer homology, surgery modules, and immersed curves

I will discuss the equivalence of knot Floer homology and bordered Floer homology (joint work with Hanselman and Ian Zemke). I will begin by describing the original Ozsváth-Szabó surgery formula and its reinterpretation by Zemke as a new version of bordered Floer homology. I will then show how this can be extended for knots in bordered manifolds, leading to a bimodule that translates between this theory and the original Lipshitz-Ozsváth-Thurston bordered theory. Finally, I will discuss how these results can be interpreted in terms of immersed curves. Our current results are for the simpler hat flavor of invariants, but we expect our methods to carry over to the stronger minus flavor.

3. 12:00 - 13:00

Jennifer Hom (Georgia Institute of Technology)

Distinguishing exotic R^4 's with Heegaard Floer homology

Attaching a Casson handle to a slice disk complement yields a smooth 4-manifold that is homeomorphic to R^4 . We show that if two slice knots have sufficiently different knot Floer homology, then the resulting exotic R^4 's made using the simplest positive Casson handle are not diffeomorphic, giving us a countably infinite family of pairwise nondiffeomorphic exotic R^4 's. Our main tool is Gadgil's end Floer homology. This is joint work with Sean Eli and Tye Lidman.

Free afternoon

Thursday: Gauge Theory

Morning

1. 9:00 - 10:00

Peter Kronheimer (Harvard University)

Panorama talk on Gauge Theory

• 10:00 - 10:30

Coffee + pastries

• 10:30 - 10:45

Lightning talks

Hayato Imori (KAIST):

Untwisting number and singular instantons

Andres David Ramirez Ruiz (University of Miami):

$SU(3)$ representations of S^3/Q_8

2. 10:45 - 11:45

Tom Mrowka (Massachusetts Institute of Technology)

Knot homologies: from the perspective of gauge theory

TBA

3. 12:00 - 13:00

Aliakbar Daemi (Washington University in St. Louis)

What can we learn from instantons if we don't think rationally?

In this talk, I will begin by discussing mod 2 instanton homology, emphasizing some of the features that distinguish it from instanton homology with rational coefficients (or, more generally, coefficients in a ring in which 2 is invertible). I will then review the definition of a numerical invariant due to Kim Frøyshov, which is defined using mod 2 instanton homology. I will describe several properties of this invariant that appear to have no analogue in the setting of rational coefficients. Finally, I will discuss some topological applications of these properties of Frøyshov's invariant.

Afternoon

• 14:30 - 16:00

Lightning talks (with coffee + pastries)

This event will be at the Rényi Institute (Reáltanoda utca 13-15, Budapest 1053)

- Jean Al Ani (University of Liverpool) (joint with Anna Pratoussevitch (University of Liverpool): Higher Spin Structures on Klein Orbifolds
- Ludovico Battista (Max Planck Institute): Can You Hear the Shape of a Hyperbolic Marimba?
- Maria Rita Casali and Paola Cristofori (University of Modena and Reggio Emilia): Kirby Diagrams, Trisections and Gems

- Alessandro V. Cigna (King's College London): A Dual Graph Approach to the Thurston Norm
- Gary D. Dunkerley (University of Georgia): Ribbon Minimality of Links via Heegaard Floer Detection Results
- Nancy Mae Eagles (University of California at Berkeley) (joint with Zijian Rong (University of Southern California)): Invariants of Legendrian Knots in Thickened Convex Surfaces
- Adrián Olivares Fernández (Universitat Jaume I) (joint with Patricio Almirón (Universidad de Valladolid)): Topological Representations of Free Numerical Semigroups via Iterated Torus Knots
- Dominik Gdesz (University of Wrocław): Low-dimensional Spin Bundles and a New Embedding of RP^7
- Douwe Hoekstra (Utrecht University) (joint with Mélanie Theilliére (Université de Rennes)): Holonomic Approximation from Convex Integration
- Luka Marčič (University of Ljubljana) (joint with Eva Horvat (University of Ljubljana)): Ribbon Concordance Quandles
- Monica Sing (Princeton University): On Morse Theory, Handle Decompositions and Knots

4. 16:30 - 17:30

Clay Lecture: John Morgan (Columbia University)

Physics, Loop Groups, and Low Dimensional Topology

It has long been known that, unlike the case of higher dimensions, topology of dimensions 3 and 4 is extremely difficult to tackle in its own terms. Ideas from other parts of mathematics and from physics have played an important role in the development of the subject. In this talk, I will review two striking examples of this phenomena, emphasizing the interplay of ideas from disparate sources. The two case studies are: (i) 4 dimensional gauge theory and its descendants and (ii) the Jones polynomial with its quantum and quantum algebraic cousins. As part of the second case study, I will discuss in some detail Graeme Segal's Loop Group approach to two-dimensional CFT.

• 18:00 - 20:00

Banquet

Friday: Knots and surfaces

Morning

1. 9:00 - 10:00

Maggie Miller (University of Texas At Austin)

Panorama talk on Knots and Surfaces

• 10:00 - 10:25

Coffee + pastries

• 10:25 - 10:45

Lightning talks

Alessio Di Prisa (Scuola NormaLe Superiore):

Every negative amphichiral knot is rationally slice

Marc Kegel (Universidad de Sevilla):

Manifolds with unique surgery descriptions

Clayton McDonald (Rényi Institute):

Knots of low rational genera

Deepanshi Saraf (IISER Tirupati):

Residual Finiteness in Fundamental Knot Invariants

2. 10:45 - 11:45

John Baldwin (Boston College)

Ribbon concordance and fibered predecessors

Agol recently proved Gordon's conjecture that ribbon concordance defines a partial order on knots in the 3-sphere. Gordon further conjectured that this partial order is well-founded, meaning that there is no infinite descending sequence of knots under ribbon concordance. We pose an even more basic conjecture: for every knot K there are only finitely many knots which are ribbon concordant to K . Our main result is that for each K there are only finitely many fibered knots ribbon concordant to K . Our proof uses results about maps on Floer homology induced by ribbon $\mathbb{Z}/2$ -homology cobordisms, a relationship between the Floer homology of a fibered knot and the fixed points of its monodromy, and a new satellite inequality in knot Floer homology proven using the immersed curves approach to bordered Floer homology. This is joint work with Jonathan Hanselman and Steven Sivek.

3. 12:00 - 13:00

Claudius Zibrowius (Ruhr University
Bochum)

Khovanov homology and Conway mutation

What has homological mirror symmetry ever done for you? I will give my personal answer to this question and discuss joint work [arXiv:2602.23442] with Liam Watson and Artem Kotelskiy concerning the behaviour of Khovanov homology under Conway mutation.