Pavel Hájek

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https://p135246.github.io (personal website)
https://www.linkedin.com/in/dr-pavel-hajek/
https://community.wolfram.com/web/hajekpavel
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Academic positions

Oct 2025–present	*Research Fellow* at the Wolfram Institute.
Oct 2019–Mar 2024	*Postdoc* with Prof. Dr. Janko Latschev at the University of Hamburg.
Jan–Feb 2021	*Visiting researcher* in the symplectic geometry group at the Humboldt University of Berlin.
Sep–Dec 2020	*Research fellow* in the program Knots, strings, symplectic geometry and dualities at the Mittag-Leffler Institute in Stockholm.

Academic memberships

Feb–Sep 2025 *Affiliate Researcher* at the Wolfram Institute.

Research interests

Symplectic geometry and mathematical physics: Perturbative Chern-Simons theory, symplectic field theory, string topology, rational homotopy theory, homotopy algebras, BV formalism.

Complex systems: Minimal models of geometry on hypergraphs (Infrageometry), emergence of structure in the limit of increasing complexity, hypergraph rewriting.

Other interests: Integrability, quantization, semi-classical physics, spinning tops, celestial mechanics, string field theory, applications of higher algebra.

Education

2015–2019	*Ph.D. in Mathematics, University of Augsburg (with Prof. Dr. Kai Cieliebak).* Thesis on an IBL-infinity chain model of equivariant string topology based on perturbative Chern-Simons theory. Final grade Magna cum laude.
2011–2014	*MSc in Theoretical and Mathematical Physics, LMU Munich.* Thesis on Eilenberg-Steenrod axioms for a homology theory based on manifolds with corners (supv. Prof. Dr. Kai Cieliebak). Graduated with high distinctions.
2007–2011	*BSc in Physics, Charles University in Prag.* Thesis on dynamical symmetries in classical and quantum mechanics (supv. prof. RNDr. Pavel Cejnar, Dr., DSc.). Graduated with distinctions.
2007–2010	*BSc in Mathematics, Charles University in Prag.* Thesis on Liouville integrability of a generalization of the Lagrange top to higher dimensions (supv. doc. RNDr. Svatopluk Krýsl, Ph.D.). Graduated with high distinction.

Scholarships

Sep–Dec 2020	Junior Fellowship from the Mittag-Leffler institute.
2012–2013	Scholarship for master studies by the DAAD.
2007–2011	Merit based scholarship from the Charles University.

Preprints and publications

[1] Kai Cieliebak, Pavel Hájek, and Evgeny Volkov. *Chain-level equivariant string topology for simply connected manifolds*. 2022. arXiv: 2202.06837 [math.AT]. Submitted to Algebraic and Geometric Topology.

[2] Pavel Hájek. "Hodge decompositions and differential Poincaré duality models". In: *Journal of Homotopy and Related Structures* (2025). DOI: 10.1007/s40062-025-00389-2.

[3] Pavel Hájek. *IBL-Infinity Model of String Topology from Perturbative Chern-Simons Theory*. 2020. arXiv: 2003.07933 [math-ph]. Ph.D. thesis.

[4] Pavel Hájek. *Twisted IBL-infinity-algebra and string topology: First look and examples*. 2019. arXiv: 1811.05281 [math-ph]. Working paper.

In preparation:

- Chern-Simons Maurer-Cartan element for S^1 (with K. Cieliebak)
- Insertion Lie brackets for hypergraphs (with Carlos Zapata-Carratalá)
- Chern-Simons Maurer-Cartan element in BV formalism (with J. Pullman and B. Jurco)
- Chern-Simons Maurer-Cartan element for product manifolds

Other contributions

- Computational essays: https://community.wolfram.com/web/hajekpavel
- Acknowledged contributor to S. Wolfram, *P vs NP and the Difficulty of Computation: A Ruliological Approach*, 2026.

University teaching

WS23	• Mathematics for physicists I (TA) • Preparatory course for Master's in Mathematical physics (lecturer)
SS23	Symplectic geometry (TA)
WS22	Introduction to Euclidean geometry (TA)
SS22	Mathematics for physicists IV (TA)
WS21	Mathematics for physicists III (TA)
SS21	Proseminar on geometry of curves (organizer)
SS20	Floer Theory (TA)
WS19	• Mathematics for physicists I (TA) • Symplectic Geometry (TA)
SS17	Analysis II (TA)
WS16	Analysis I (TA)
SS16	Seminar on Floer homology (coorganizer)
SS15	• Linear Algebra II (TA)

	• Preparatory course for math teachers (TA)
WS14	• Linear Algebra I (TA)
	• Preparatory course for math teachers (TA)
WS13	Algebraic Topology II (HW corrector)
SS12	Algebraic Topology I (HW corrector)

2022 Opponent on Bachelor's thesis.
2021 Opponent on Master's thesis.

Other teaching

2026 Lectures on Hypergraph Rewriting and Infrageometry at the Wolfram Winter School 2026.

2026 Mentored two students at the Wolfram Winter School 2026.

Event organization

2018 Helped with organization of Workshop on Symplectic Field Theory IX, University of Augsburg, August 25–31.

Scientific software

Contributed to *Wolfram Language Paclets*:
- Hypergraph: Hypergraph insertion Lie brackets and its graded version.
- Infrageometry: Framework for simplicial sets, fibered graphs, and other.

Contributed several functions to the Wolfram Function Repository.

Conference talks

2026 • Infrageometry: Geometry Emerging from Hypergraph Rewriting, From Geometric Ideas to Computational Frontiers, Universidad Complutense de Madrid, February 20.
• Computational Experiments at Wolfram Institute, 46th Winter School Geometry and Physics, Srní, January 17–24.
2023 Maurer-Cartan element from Chern-Simons theory, Research seminar, University of Odense, February 20.
2022 Chain models of string topology based on de Rham forms, Research seminar on algebraic topology, University of Hamburg, May 19.
2021 Chain models of string topology coming from symplectic geometry I & II, Symplectic seminar of the Humboldt University of Berlin, January 11 and 25.
2020 • Symplectic chain models of string topology, Mathematical Institute of Charles University in Prague, December 17.
• Chern-Simons theory on S^1 I & II, Informal seminar at the Mittag-Leffler institute, Stockholm, September 16 and 21.
• IBL_∞ chain model of equivariant string topology from perturbative Chern-Simons theory, Seminar on Lie groups and moduli spaces, University of Geneva, June 16.

2019 • Computations of the IBL_∞ structure, Workshop on String field theory, BV quantization, and moduli spaces, Simons Center for Geometry and Physics, Stony Brook, May 20–24.
• Explicit computation of Feynman integrals, Seminar for symplectic geometry, University of Augsburg, May 13, 2019.
• IBL_∞ formality and Poincaré duality models, Seminar for symplectic and contact geometry at the University of Hamburg, April 25.
• Chern-Simons theory and string topology, Seminar of the Research Institute for Mathematical Science, Kyoto, March 14.
• Feynman integrals with the Green kernel, Seminar of the Mathematical Institute at the University of Potsdam, February 28.
• IBL_∞ structure and string topology conjecture, 39th Winter School Geometry and Physics, Srní, January 12–19.

2016 Presentation of a part of the proof of the Cheeger-Müller theorem, Block seminar on Torsion in Geometry and Topology, Schloss Gollwitz, Brandenburg, July 3–8.

2015 Homology theory based on manifolds with corners, Meeting of symplectic geometers, Weimar, Germany, 16–18 January.

Some talks in university seminars:

Abouzaid's generation criterion; Costello's work on TCFT; Chas-Sullivan string topology; Cyclic homology; Seiberg-Witten theory; Symplectic capacities and the ball packing problem; Witten's non-perturbative treatment of Chern-Simons theory; Propagators and linking numbers; Chaotic dynamics of the restricted three-body problem near the Lagrange points; Molecules of the Euler top.

Other public talks

2025 Insertion Lie Bracket for Hypergraphs, Wolfram Institute Livestream, April 2025.

Conferences attended

2026 • From Geometric Ideas to Computational Frontiers, Universidad Complutense de Madrid, February 20.
• 46th Winter School Geometry and Physics, Srní, January 17–24.

2024 Higher Structures in Prague, Prague, October 14–18.

2023 43rd Winter School Geometry and Physics, Srní, January 14–21.

2022 Geometry and Topology, ICM sectional workshop, University of Copenhagen, July 6–14.

2022 42nd Winter School Geometry and Physics, Srní, January 15–22.

2020 40th Winter School Geometry and Physics, Srní, January 11–18.

2019 • Geometric Dynamic Days 2019, RWTH Aachen, November 15–16.
• Workshop on String field theory, BV quantization, and moduli spaces, Simons Center for Geometry and Physics, Stony Brook, May 20–24.
• 39th Winter School Geometry and Physics, Srní, January 12–19.

2018 Workshop on Symplectic Field Theory IX, University of Augsburg. August 25–31.

2017 Meeting of symplectic geometers, Free University of Berlin, February 17–19.

2016 • Block seminar on Torsion in Geometry and Topology, Schloss Gollwitz, July 3–8.

• X Workshop on Symplectic Geometry, Contact Geometry, and Interactions, University of Augsburg, February 25–27.

2015 • Summer School on String Topology and Rational Homotopy Theory, University of Hamburg, September 2–4.
• Moduli Spaces in Symplectic Topology and in Gauge Theory, CIRM, June 1–5.
• 35th Winter School Geometry and Physics, Srní, 17–24 January.
• Meeting of symplectic geometers, Weimar, 16–18 January.

2014 Loop spaces in geometry and topology, University of Nantes, 1–5 September.

2013 Minicourse on free loop spaces in topology and physics, University of Münster, 24 April.

2012 Poisson Geometry in Mathematics and Physics, University of Utrecht, 23 July–3 August.

Languages

Czech mother tongue,
English full professional proficiency,
German full professional proficiency.

Hobbies

Windsurfing