

# MANUEL KRANNICH

## PERSONAL DATA

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ADDRESS: Karlsruhe Institute of Technology  
Department of Mathematics  
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RESEARCH INTERESTS: Algebraic and Geometric Topology  
(topology of moduli spaces, manifold bundles and their characteristic classes, automorphism and embedding spaces of manifolds, mapping class groups, surgery theory, cobordism categories, configuration spaces, K-theory, arithmetic groups, applications to differential geometry)

## POSITIONS

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since Apr 2022	KARLSRUHE INSTITUTE OF TECHNOLOGY Junior Professor (Tenure-Track, W1 to W3) Department of Mathematics
Oct 2021 – Mar 2022	UNIVERSITY OF MÜNSTER Postdoc Mathematics Münster: Dynamics–Geometry–Structure Postdoctoral mentor: Michael Weiss
Oct 2018 – Sept 2021	UNIVERSITY OF CAMBRIDGE Research Associate Department of Pure Mathematics and Mathematical Statistics Postdoctoral mentor: Oscar Randal-Williams

## EDUCATION

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2015 – 2018	UNIVERSITY OF COPENHAGEN PhD in Mathematics Member of the Centre for Symmetry and Deformation Thesis: <i>On characteristic classes of manifold bundles</i> Advisor: Nathalie Wahl
2013 – 2015	KARLSRUHE INSTITUTE OF TECHNOLOGY Master of Science (M.Sc.) in Mathematics
2010 – 2013	KARLSRUHE INSTITUTE OF TECHNOLOGY Bachelor of Science (B.Sc.) in Mathematics

## AWARDS

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2019	UNIVERSITY OF COPENHAGEN <i>SCIENCE PhD Award 2019</i> for one of the three best PhD theses in sciences of the year.
2015	KARLSRUHE INSTITUTE OF TECHNOLOGY <i>Faculty Award 2015</i> for the best master's degree of the year.

2013      KARLSRUHE INSTITUTE OF TECHNOLOGY  
*Faculty Award 2013* for the best bachelor's degree of the year.

#### SCHOLARSHIPS, STIPENDS, AND GRANTS

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since 2022	Principal Investigator of the Research Training Group 2229 "Asymptotic Invariants and Limits of Groups and Spaces" funded by the DFG (acquired funding for a PhD student through a supplementary proposal).
2015 – 2018	University of Copenhagen, Centre of Symmetry and Deformation, Department of Mathematical Sciences <i>PhD stipend.</i>
2013 – 2015	German National Academic Foundation <i>Scholarship.</i>
2012 – 2013	German Federal Ministry of Education and Research <i>Scholarship Deutschlandstipendium.</i>
2011 – 2012	German Federal Ministry of Education and Research <i>Scholarship Deutschlandstipendium.</i>

#### EXTENDED VISITS

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JAN 2022 – MAR 2022	INSTITUT MITTAG-LEFFLER Attending research programme <i>Higher algebraic structures in algebra, topology and geometry.</i>
APR 2018, MAR 2019, MAR 2020	HARVARD UNIVERSITY Visiting Alexander Kupers.
FEB 2018 – APR 2018	STANFORD UNIVERSITY Visiting Søren Galatius.
JAN 2017 – APR 2017	UNIVERSITY OF CAMBRIDGE Visiting Oscar Randal-Williams.

#### PUBLICATIONS

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- Mauricio Bustamante, Manuel Krannich, and Alexander Kupers, *Finiteness properties of automorphism spaces of manifolds with finite fundamental group*. Mathematische Annalen, to appear. Online version available at [doi.org/10.1007/s00208-023-02594-x](https://doi.org/10.1007/s00208-023-02594-x).
- Thomas Goodwillie, Manuel Krannich, and Alexander Kupers, *Stability of concordance embeddings*. Proceedings of the Royal Society of Edinburgh (Memorial volume in honour of Andrew Ranicki), to appear. Online version available at [doi.org/10.1017/prm.2023.17](https://doi.org/10.1017/prm.2023.17).
- Manuel Krannich and Alexander Kupers, *Embedding calculus for surfaces*. Algebraic & Geometric Topology, to appear. Preprint available at arXiv:[2101.07885](https://arxiv.org/abs/2101.07885).
- Manuel Krannich, *A homological approach to pseudoisotopy theory. I*. Inventiones Mathematicae, **227** (2022) no. 3 1093–1167.
- Manuel Krannich, Alexander Kupers, and Oscar Randal-Williams, *An  $HP^2$ -bundle over  $S^4$  with nontrivial  $\hat{A}$ -genus*. Comptes Rendus. Mathématique, Tome **359** (2021) no. 2, pp. 149–154.
- Bena Tshishiku, with an appendix by Manuel Krannich, *Geometric cycles and characteristic classes of manifold bundles*.

Commentarii Mathematici Helvetici, **96** (1) (2021), 1–45.

- Manuel Krannich, *Mapping class groups of highly connected  $(4k+2)$ -manifolds*. Selecta Mathematica, **26**, 81 (2020).
- Manuel Krannich and Oscar Randal-Williams, *Mapping class groups of simply connected high-dimensional manifolds need not be arithmetic*. Comptes Rendus. Mathématique, Tome **358** (2020) no. 4, pp. 469–473.
- Manuel Krannich, *A note on rational homological stability of automorphisms of manifolds*. The Quarterly Journal of Mathematics **71** (3) (2020), 1069–1079.
- Manuel Krannich and Alexander Kupers, *Some Hermitian  $K$ -groups via geometric topology*. Proceedings of the American Mathematical Society **149** (2021), 2745–2752.
- Manuel Krannich and Jens Reinhold, *Characteristic numbers of manifold bundles over surfaces with highly connected fibers*. Journal of the London Mathematical Society **102** (2) (2020), 879–904.
- Manuel Krannich, *On characteristic classes of exotic manifold bundles*. Mathematische Annalen **379** (2021), 1–21.
- Manuel Krannich, *Homological stability of topological moduli spaces*. Geometry & Topology **23** (5) (2019), 2397–2474.

## PREPRINTS

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- Geoffroy Horel, Manuel Krannich, and Alexander Kupers, *Two remarks on spaces of maps between operads of little cubes*. Preprint (2022), arXiv:[2211.00908](#).
- Manuel Krannich and Alexander Kupers, *The Disc-structure space*. Preprint (2022), arXiv:[2205.01755](#).
- Manuel Krannich and Oscar Randal-Williams, *Diffeomorphisms of discs and the second Weiss derivative of  $B\mathrm{Top}(-)$* . Preprint (2021), arXiv:[2109.03500](#).
- Manuel Krannich and Alexander Kupers, *On Torelli groups and Dehn twists of smooth 4-manifolds*. Preprint (2021), arXiv:[2105.08904](#).

## CONTRIBUTIONS TO CONFERENCE PROCEEDINGS

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- Manuel Krannich, *Stability of concordance embeddings*. Oberwolfach Reports, to appear.
- Manuel Krannich, *Moduli spaces of  $h$ -cobordisms of discs*. Oberwolfach Reports **17** (2020), no. 21, 1089–1090.
- Manuel Krannich, *Pseudoisotopies of even discs, revisited*. Oberwolfach Reports **17** (2020), no. 1, 431–432.

## INVITED TALKS

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| AUG 2023  | TBD, Workshop: String topology and connections to BV-quantization, symplectic topology, and manifold topology, Dublin (scheduled). |
| JULY 2023 | TBD, Workshop: Algebraic K-Theory of Spaces, Regensburg (scheduled).   |
| JUN 2023  | TBD, Oberseminar Differentialgeometrie, Augsburg (scheduled).  |
| MAY 2023  | TBD, Workshop on Homology of Configuration Spaces and related topics, Paris (scheduled).   |

- MAR 2023 *Pontryagin classes of Euclidean fibre bundles over spheres*, Dublin Mathematics Colloquium, Dublin (scheduled).
- FEB 2023 *Diffeomorphisms of discs*, Colloquium, LMU Munich.
- JAN 2023 *Manifolds and calculus*, Chromatic Homotopy, K-Theory and Functors, CIRM, Luminy.
- OCT 2022 *Manifolds and calculus*, Ib Fest: On the occasion of Ib Madsen's 80'th birthday, Copenhagen.
- SEP 2022 *Multirelative connectivity results in geometric topology*, 4-Manifolds: from Above and Below, CIRM, Luminy.
- SEP 2022 *The Disc-structure space*, Classifying spaces in homotopy theory: in honour of Ran Levi's 60th Birthday, ICMS, Edinburgh.
- JULY 2022 *Stability of concordance embeddings*, Topologie, Oberwolfach.
- JUNE 2022 *The Disc-structure space*, Topology Seminar, Kansas State University.
- JUNE 2022 *The Disc-structure space*, Topology Seminar, Bonn.
- MAY 2022 *Top(d) and orthogonal calculus*, Topology Seminar, Stockholm.
- FEB 2022 *The Disc-structure space*, Higher algebraic structures in algebra, topology and geometry, Institut Mittag-Leffler, Stockholm.
- FEB 2022 *Pseudoisotopies of discs and  $K(\mathbb{Z})$* , Oberseminar Geometrie und Topologie, Göttingen.
- DEC 2021 *Smoothing fibre bundles and diffeomorphism groups of discs*, IMUNAM Algebraic Topology Seminar, Mexico City.
- OCT 2021 *Top(d) and orthogonal calculus*, Topology Seminar, Münster.
- JULY 2021 *(In)finiteness properties of automorphism spaces of manifolds*, AG-Seminar, Regensburg.
- APR 2021 *Embedding calculus, factorisation homology, and surfaces*, Séminaire de l'équipe Topologie Algébrique, Université Sorbonne Paris Nord (Paris 13).
- APR 2021 *Embedding calculus in codimension zero*, Building Bridges Seminar: Invariants of Embedding spaces, virtual.
- FEB 2021 *Smoothing fibre bundles and diffeomorphism groups of discs*, Geometry & Topology Seminar, Toronto.
- JULY 2020 *Moduli spaces of  $h$ -cobordisms of discs*, Topologie, Oberwolfach.
- MAY 2020 *Pseudoisotopies of discs and algebraic  $K$ -theory of the integers*, Topology Seminar, Purdue.
- MAY 2020 *The pseudoisotopy stable range*, Topology Seminar, Bonn.
- MAR 2020 *Pseudoisotopies of even discs and algebraic  $K$ -theory of the integers*, Topology Seminar, Wayne State.
- MAR 2020 *Pseudoisotopies of even discs and algebraic  $K$ -theory of the integers*, Geometry & Topology Seminar, Brown.
- MAR 2020 *Pseudoisotopies of even discs and algebraic  $K$ -theory of the integers*, Topology Seminar, Brandeis.
- FEB 2020 *Pseudoisotopies of even discs, revisited*, Manifolds and Groups, Oberwolfach.
- JAN 2020 *A homological approach to pseudoisotopy theory*, Topology Seminar, Warwick.
- DEC 2019 *A homological approach to pseudoisotopy theory*, Topology Seminar, Münster.
- NOV 2019 *Diffeomorphism groups of discs*, Topology Seminar, Aberdeen.
- OCT 2019 *Mapping class groups, signatures, and arithmeticity*, MPI Topology Seminar, Bonn.
- JULY 2019 *Diffeomorphism groups of discs*, Four Manifolds: Confluence of High and Low Dimensions, Fields Institute, Toronto.
- JUNE 2019 *Rational homotopy groups of diffeomorphism group of discs, revisited* (short talk), Conference: SYM 10 Years Old, Copenhagen.
- APR 2019 *Mapping class groups of highly connected manifolds*, Utrecht Geometry Centre Seminar, Utrecht.

- APR 2019 *Mapping class groups of highly connected manifolds*, Seminar in Algebra & Geometry, Stockholm.
- MAR 2019 *Mapping class groups of highly connected manifolds*, Topology Seminar, MIT.
- JAN 2019 *Mapping class groups of highly connected manifolds*, Geometry and Topology Seminar, Durham.
- DEC 2018 *On the signature of bundles over surfaces*, Oberseminar Differentialgeometrie, Augsburg.
- DEC 2018 *Mapping class groups of highly connected manifolds*, Bavarian Geometry and Topology Seminar, Augsburg.
- NOV 2018 *Detecting exotic smooth structures in diffeomorphism groups*, Differential Geometry and Topology Seminar, Cambridge.
- SEPT 2018 *Topological moduli spaces,  $E_2$ -algebras, and homological stability*, Workshop: Cohomological study of mapping class groups and related topics, Strasbourg.
- APR 2018 *Characteristic numbers of manifold bundles over surfaces with highly connected fibres*, Oxford–Aberdeen–Cambridge Meeting on Manifolds, Cambridge.
- APR 2018 *Homological stability of topological moduli spaces*, Topology Seminar, Purdue.
- APR 2018 *Detecting exotic smooth structures in diffeomorphism groups*, Topology Seminar, Northwestern.
- APR 2018 *Topological moduli spaces,  $E_2$ -algebras, and homological stability*, Geometry/Topology Seminar and Topology Seminar (joint), University of Chicago.
- JAN 2018 *On characteristic classes of exotic manifold bundles*, Topology Seminar, Bonn.
- JAN 2018 *On characteristic classes of exotic manifold bundles*, Topology Seminar, Karlsruhe.
- JAN 2018 *On characteristic classes of exotic manifold bundles*, Topology Seminar, Münster.
- OCT 2017 *On characteristic classes of exotic manifold bundles*, Topology Seminar, Copenhagen.
- MAR 2017 *Homological stability of  $E_1$ -modules over  $E_2$ -algebras and twisted stability of topological moduli spaces*, Topology Seminar, Aberdeen.
- MAR 2017 *Moduli spaces of manifolds*, Geometry Tea, Cambridge.
- JUNE 2015 *Through scanning to the theorem of Galatius-Madsen-Tillmann-Weiss*, Topology Seminar, Karlsruhe.

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#### CONTRIBUTED TALKS

- JUNE 2021 *The Disc-structure space*, Conference *Manifolds and K-theory: the legacy of Andrew Ranicki*, Edinburgh.
- DEC 2018 *Mapping class groups of highly connected manifolds*, Workshop "Manifolds", part the programme "Homotopy harnessing higher structures", Newton Institute, Cambridge.
- JUN 2018 *On the signature of smooth bundles over surfaces*, International Conference on Manifolds, Groups and Homotopy, Skye.
- SEPT 2017 *On characteristic classes of bundles of manifolds connect summed with an exotic sphere* (short talk), Research School: Algebraic Topology of Manifolds, Oxford.
- JULY 2017 *On the cohomology of moduli spaces of manifolds connect summed with an exotic sphere*, Young Topologists Meeting, Stockholm.
- SEPT 2016 *Homological stability of  $E_2$ -modules and twisted stability of moduli spaces of manifolds*, European Autumn School in Topology 2016, Utrecht.
- MAY 2016 *Scanning & stability — Scrutinizing topological moduli spaces*, ALG/NCG/TOP PhD students' seminar, Copenhagen.

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#### SERVICE

since 2018	Referee reports and opinions for various journals in mathematics including <i>Acta Mathematica</i> , <i>Advances in Mathematics</i> , <i>Algebraic &amp; Geometric Topology</i> , <i>Crelle</i> , <i>Forum of Mathematics Sigma</i> , <i>Geometry &amp; Topology</i> , <i>Journal of Topology</i> , <i>Mathematische Annalen</i> , <i>Selecta Mathematica</i> .
NOVEMBER 2023	Organiser of the workshop <i>Spaces of manifolds: algebraic and geometric approaches</i> , Banff International Research Station.
MAY 2023	External examiner for PhD thesis of Erik Lindell, Stockholm University.
SINCE MAY 2022	Organiser of the <i>Online Seminar on Manifolds, homotopy theory, and related topics</i> , jointly with Alexander Kupers and Oscar Randal-Williams.
MAY 2022	External examiner for licentiate thesis of Robin Stoll, Stockholm University.
SPRING 2021	Organiser of the <i>Seminar on Factorisation Homology</i> , Cambridge.
FALL 2019	Organiser of the <i>Seminar on work of Weiss and Williams</i> , Cambridge.
JAN 2016 – SEPT 2018	Organiser of pre-talks to the <i>Topology Seminar</i> , Copenhagen.
AUG 2016 – SEPT 2018	Organiser of the <i>ALG/NCG/TOP PhD students' seminar</i> , Copenhagen.
JULY 2016	Organiser of the conference <i>Young Topologists Meeting 2016</i> , Copenhagen.

## OUTREACH

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SEPT 2019	Talk <i>Symmetries of exotic spheres</i> , PhD Graduation Ceremony, Faculty of Science, Copenhagen.
MAY 2018	Talk <i>An algebraic topological aperitif</i> , course on University Pedagogy, Department of Science Education, Copenhagen.
OCT 2017	Talk <i>What is an exotic sphere?</i> , site visit of the DNRF (Danish National Research Foundation), Department of Mathematical Sciences, Copenhagen.

## SUPERVISION AND MENTORING EXPERIENCE

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since Apr 2023	PhD advisor of João Lobo Fernandes.
since Oct 2022	Postdoctoral mentor of Florian Kranhold.
SUMMER 2023	Supervision of a Master's thesis.

## TEACHING EXPERIENCE

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SUMMER 2023	Seminar: <i>Cohomology and Characteristic Classes</i> , Karlsruhe, Lecturer.
WINTER 2022/2023	Lecture: <i>Algebraic Topology</i> , Karlsruhe, Lecturer.
SUMMER 2022	Seminar: <i>Vector bundles and topological K-theory</i> , Karlsruhe, Lecturer.
FALL 2020	Lecture series: <i>Lectures on Manifold Topology: Exotic Spheres</i> , Lecturer (as part of the Online Graduate Lecture Series of the London Mathematical Society).
FALL 2017	Lecture: <i>Algebraic Topology</i> , Copenhagen, Teaching Assistant.
FALL 2016	Lecture: <i>Algebraic Topology</i> , Copenhagen, Teaching Assistant.
SUMMER 2015	Lecture: <i>Algebraic Topology</i> , Karlsruhe, Tutor.
WINTER 2014/2015	Lecture: <i>Introduction into Geometry and Topology</i> , Karlsruhe, Tutor.
WINTER 2013/2014	Lecture: <i>Differential Geometry</i> , Karlsruhe, Teaching Assistant.
SUMMER 2013	Lecture: <i>Introduction into Algebra and Number Theory</i> , Karlsruhe, Tutor.
WINTER 2012/2013	Lecture: <i>Introduction into Geometry and Topology</i> , Karlsruhe, Tutor.
SUMMER 2012	Lecture: <i>Linear Algebra II</i> , Karlsruhe, Tutor.
WINTER 2012/2013	Lecture: <i>Linear Algebra I</i> , Karlsruhe, Tutor.

## CONFERENCES AND WORKSHOPS ATTENDED

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AUGUST 2023	TBD, Workshop: String topology and connections to BV-quantization, symplectic topology, and manifold topology, Dublin (scheduled).
JULY 2023	TBD, Workshop: Algebraic K-Theory of Spaces, Regensburg (scheduled).
JAN 2023	Workshop, <i>Workshop on Homology of Configuration Spaces and related topics</i> , Paris. (scheduled).
JAN 2023	Conference, <i>Chromatic Homotopy, K-Theory and Functors</i> , CIRM, Luminy. (scheduled).
OCT 2022	Conference, <i>Ib Fest: Conference on the occasion of Ib Madsen's 80th birthday</i> , Copenhagen.
SEP 2022	Workshop, <i>4-Manifolds: from Above and Below</i> , CIRM, Luminy.
SEP 2022	Workshop, <i>Classifying spaces in homotopy theory: in honour of Ran Levi's 60th Birthday</i> , ICMS, Edinburgh.
JULY 2022	Workshop, <i>Topologie</i> , Oberwolfach.
JUNE 2021	Conference <i>Manifolds and K-theory: the legacy of Andrew Ranicki</i> , Edinburgh.
JULY 2020	Workshop <i>Topologie</i> , Oberwolfach.
FEB 2020	Workshop <i>Manifolds and Groups</i> , Oberwolfach.
OCT 2019	Workshop <i>2019 Clay Research Conference and Workshops</i> , Oxford.
SEPT 2019	Workshop <i>Automorphisms of Manifolds</i> , Hausdorff Center, Bonn.
JUL 2019	Workshop <i>Four Manifolds: Confluence of High and Low Dimensions</i> , Fields Institute, Toronto.
JUN 2019	Conference <i>SYM 10 years old</i> , Copenhagen.
DEC 2018	Conference <i>Bavarian Topology and Geometry Meeting</i> , Augsburg.
DEC 2018	Workshop <i>Manifolds</i> , part of the programme <i>Homotopy harnessing higher structures</i> , Isaac Newton Institute, Cambridge.
SEPT 2018	Workshop <i>Cohomological study of mapping class groups and related topics</i> , Strasbourg.
JULY 2018	Conference <i>Young Topologists Meeting 2018</i> , Copenhagen.
JUNE 2018	Conference <i>Manifolds, Groups and Homotopy</i> , Skye.
JUNE 2018	Workshop <i>Secondary and delocalized index invariants</i> , Copenhagen.
APR 2018	Oxford–Aberdeen–Cambridge meeting on <i>Manifolds</i> , Cambridge.
APR 2018	Conference <i>Graduate Student Topology and Geometry Conference</i> , Chicago.
SEPT 2017	Research School <i>Algebraic Topology of Manifolds</i> , Oxford.
JULY 2017	Conference <i>Young Topologists Meeting 2017</i> , Stockholm.
JUNE 2017	Masterclass <i>Stable Homotopy Theory and p-Adic Hodge Theory</i> , Copenhagen.
JUNE 2017	Conference <i>Groups, Manifolds and K-Theory</i> , Münster.
MAY 2017	Masterclass <i>Cohomology of Arithmetic Groups</i> , Copenhagen.
APR 2017	Conference <i>Moduli and Traces</i> , Copenhagen.
MAR 2017	Oxford–Aberdeen–Cambridge meeting on <i>Manifolds</i> , Oxford.
DEC 2016	Winter School on <i>Bordism, L-theory, and Real Algebraic K-Theory</i> , Regensburg.
OCT 2016	Conference <i>Configuration Spaces and Moduli Spaces in Homotopy Theory</i> , Bonn.
SEPT 2016	Autumn School <i>European Autumn School in Topology 2016</i> , Utrecht.
JULY 2016	Conference <i>Young Topologists Meeting 2016</i> , Copenhagen.
JUNE 2016	Conference <i>Topology of Manifolds</i> , Lisbon.
JUNE 2016	Conference <i>Algebra in Geometry</i> , Copenhagen.
FEB 2016	Oxford–Aberdeen–Cambridge meeting on <i>Manifolds</i> , Oxford.
NOV 2015	Workshop on <i>Automorphism of Free Groups</i> , Copenhagen.

MAY 2015	Introductory School to TP <i>Homotopy Theory, Manifolds and Field Theories</i> , Bonn.
FEB 2014	Karlsruhe–Stuttgart Seminar <i>Representation Theory and Geometry</i> , Blaubeuren.
JUNE 2014	Summer School on <i>Surgery Theory and its Applications in Geometry</i> , Münster.