

Lukas Lewark

Curriculum Vitae

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Employment

- since 08/23 Senior Scientist at the ETH Zürich.
- 04/19 – 07/23 Emmy Noether Independent Junior Research Group Leader at the University of Regensburg. My project *Quantum invariants, knot concordance and unknotting* was funded by the DFG.
- 08/14 – 02/19 Postdoc at the University of Bern with Sebastian Baader.
- 04/13 – 03/14 Postdoc at Durham University with Andrew Lobb.

Education and Diploma

- 10/19 – 07/13 Habilitation at the Universität Regensburg.
- 10/09 – 06/13 PhD at the Institut de Mathématiques de Jussieu (IMJ), Paris, France. Thesis *Khovanov-Rozansky homologies, knotted weighted webs and the slice genus* supervised by Christian Blanchet. Defended 28 June 2013.
- 01/08 – 05/09 MSc Math. with distinction at ETH Zürich, Switzerland.
- 09/04 – 03/08 BSc Math. at ETH Zürich.
- 06/04 Abitur at Friedrich Gymnasium, Freiburg, Germany.

Visits

- 04/23 – 05/23 Guest of the FIM at the ETH Zürich.
- 01/17 – 06/17 *Homology Theories in Low Dimensional Topology* at Newton Institute in Cambridge for a total of four weeks.
 - 10/16 Guest of the MPIM Bonn.
- 04/14 – 07/14 Guest of the MPIM Bonn.

Research group

- 11/23 – Miguel O. Rodriguez (postdoc), co-funded by Peter Feller.
- 09/20 – 08/22 Claudius Zibrowius (postdoc).
- 04/19 – 03/23 Damian Iltgen (PhD student, defended 9 February 2023).

Publications

Peer-reviewed articles

21. *3-braid knots with maximal 4-genus* — by S. Baader, L. Lewark, F. Misev, P. Truöl. **Transactions of the AMS Ser. B** (accepted for publication). <https://arxiv.org/abs/2303.11918>
20. *On the values taken by slice torus invariants* — by P. Feller, L. Lewark, A. Lobb. **Mathematical Proceedings of the Cambridge Philosophical Society** 176 (2024), no. 1, pp. 55–63. <https://arxiv.org/abs/2202.13818>
19. *Quasipositivity and braid index of pretzel knots* — by L. Lewark. **Communications in Analysis and Geometry** (accepted for publication). <https://arxiv.org/abs/2205.05347>
18. *Squeezed Knots* — by P. Feller, L. Lewark, A. Lobb. **Quantum Topology** (accepted for publication). <https://arxiv.org/abs/2202.12289>
17. *Almost positive links are strongly quasipositive* — by P. Feller, L. Lewark, A. Lobb. **Mathematische Annalen** (2023), vol. 385, pp. 481–510. <https://doi.org/10.1007/s00208-021-02328-x>
16. *Rasmussen invariants* — by L. Lewark, C. Zibrowius. **Mathematical Research Postcards** (2021), vol. 1 no. 2. <https://secure.math.ubc.ca/Links/mrp/>
15. *Homotopy ribbon concordance, Blanchfield pairings, and twisted Alexander polynomials* — by S. Friedl, T. Kitayama, L. Lewark, M. Nagel, M. Powell. **Canadian Journal of Mathematics** (2022), vol. 74, no. 4, pp. 1137–1176. <https://doi.org/10.4153/S0008414X21000183>
14. *Untwisting 3-strand torus knots* — by S. Baader, I. Banfield, L. Lewark. **Bulletin of the London Mathematical Society** 52 (2020), no. 3, pp. 429–436. <http://dx.doi.org/10.1112/blms.12335>
13. *Balanced algebraic unknotting, linking forms, and surfaces in three- and four-space* — by P. Feller, L. Lewark. **Journal of Differential Geometry** (accepted for publication). <https://arxiv.org/abs/1905.08305>
12. *Average four-genus of two-bridge knots* — by S. Baader, A. Kjachukova, L. Lewark, F. Misev, A. Ray. **Proceedings of the AMS** (accepted for publication). <https://doi.org/10.1090/proc/14784>
11. *Upsilon-like concordance invariants from \mathfrak{sl}_n knot cohomology* — by L. Lewark, A. Lobb. **Geometry & Topology** 23 (2019), no. 2, pp. 745–780. <https://doi.org/10.2140/gt.2019.23.745>
10. *Checkerboard graph monodromies* — by S. Baader, L. Lewark, L. Liechti. **L’Enseignement Mathématique** 64 (2018), no. 2, pp. 65–88. <https://doi.org/10.4171/LEM/64-1/2-3>

9. *On calculating the slice genera of 11- and 12-crossing knots* — by L. Lewark, D. McCoy. **Experimental Mathematics** 28 (2019), no. 1, pp. 81–94. <https://doi.org/10.1080/10586458.2017.1353453>
8. *On classical upper bounds for slice genera* — by P. Feller, L. Lewark. **Selecta Mathematica** 24 (2018), no. 5, pp. 4885–4916. <http://doi.org/10.1007/s00029-018-0435-x>
7. *Khovanov width and dealternation number of positive braid links* — by S. Baader, P. Feller, L. Lewark, R. Zentner. **Mathematical Research Letters** 26 (2019), no. 3, pp. 627–641. <https://dx.doi.org/10.4310/MRL.2019.v26.n3.a1>
6. *On the topological 4-genus of torus knots* — by S. Baader, P. Feller, L. Lewark, L. Liechti. **Transactions of the AMS** 370 (2018), no. 4, pp. 2639–2656. <https://doi.org/10.1090/tran/7051>
5. *The stable 4-genus of alternating knots* — by S. Baader, L. Lewark. **Asian Journal of Mathematics** 21 (2017), no. 6, pp. 1183–1190. <https://doi.org/10.4310/AJM.2017.v21.n6.a8>
4. *New quantum obstructions to sliceness* — by L. Lewark, A. Lobb. **Proceedings of the LMS** 11 (2016), no. 1, pp. 81–114. <https://doi.org/10.1112/plms/pdv068>
3. *On stable \mathfrak{sl}_3 -homology of torus knots* — by E. Gorsky, L. Lewark. **Experimental Mathematics** 24 (2015), no. 2, pp. 162–174. <https://doi.org/10.1080/10586458.2014.963746>
2. *Rasmussen’s spectral sequences and the \mathfrak{sl}_N -concordance invariants* — by L. Lewark. **Advances in Mathematics** 260C (2014), pp. 59–83. <https://doi.org/10.1016/j.aim.2014.04.003>
1. *\mathfrak{sl}_3 -foam homology calculations* — by L. Lewark. **Algebraic & Geometric Topology** 13 (2013), no. 6, pp. 3661–3686. <https://doi.org/10.2140/agt.2013.13.3661>

Preprints

5. *The second coefficient of the Alexander polynomial as a satellite obstruction* — by L. Lewark. <https://arxiv.org/abs/2402.03155>
4. *A new concordance homomorphism from Khovanov homology* — by L. Lewark. <https://arxiv.org/abs/2401.08480>
3. *On unknotting fibered positive knots and braids* — by M. Kegel, L. Lewark, N. Manikandan, F. Misev, L. Mousseau and M. Silvero. <https://arxiv.org/abs/2312.07339>
2. *Rasmussen invariants of Whitehead doubles and other satellites* — by L. Lewark, C. Zibrowius. <https://arxiv.org/abs/2208.13612>
1. *Khovanov homology and rational unknotting* — by D. Iltgen, L. Lewark, L. Marino. <https://arxiv.org/abs/2110.15107>

Teaching

Courses

- 2024 *Algebraic Topology II*, ETHZ.
- 2023 *Analysis II* for Computer Science, ETHZ.
Mathematik I for Earth and Climate, Food, Agricultural, and Environmental Sciences (co-taught with Ana Cannas), ETHZ.
- 2020 *Analysis III* for Physics, Regensburg.
- 2019 *Knot Theory*, mathematics bachelor/master, Regensburg.
- 2018 *Algebraic Topology*, mathematics master, Bern.
- 2017 *Mathematics*, first-year biology, Bern.
- 2017 Seminar *Quadratic Forms in Topology*, mathematics master, Bern.
- 2016 *Topology*, mathematics bachelor/master, Bern.
- 2015 *Graph Theory* mathematics bachelor/master, Bern.
- 2013 *Mathematics* (“MM2”), first-year mathematics, IMJ, co-taught with two other lecturers.

Supervision

- '22 – '23 Second advisor for the PhD thesis of Paula Truöl at ETH Zürich.
- 2022 Master thesis *Implementing the Sarkar-Wang nicefication algorithm for Heegaard diagrams* by Ludovico Morellato (co-supervised with Claudius Zibrowius), in Regensburg.
- 2021 Master thesis *Determining the Seifert genus via the Heegaard Floer tangle invariant HFT* by Benedikt Aubeck (co-supervised with Claudius Zibrowius), in Regensburg.
- 2020 Master thesis *Khovanov homology and the unknotting number* by Laura Marino, in Regensburg.
- 2019 Master thesis *On the Slice Genus of Twist Knots* by Damian Iltgen, in Bern.
- '16 – '18 Bachelor theses *A Different Approach to Alternating Knots* by Nafie Tairi, *Small Cancellation Theory* by Claire Gürtler, *Forbidden minors of partial 3-trees* by Marc Trautmann, all in Bern.

Further teaching

- 2023 One-week minicourse on *Khovanov homology* at the Baby geometri seminar in Pisa.
- 2020 Reading course on *Khovanov homology*.
- '16 – '18 One-week introductory courses for first-years (3 times, Bern).
- '10 – '11 One-week repetition courses for first-years (twice, ETHZ).
- 2009 One semester at the high school Alte Kantonsschule Aarau.
- '06 – '18 12 exercise classes in total taught at ETHZ, IMJ and in Bern.
- '06 – '09 Co-supervision of seminars for the participants of the Landeswettbewerb Mathematik Baden-Württemberg (4 times).

Conference and seminar organization

- 2023 *Swiss Knots* in Regensburg.
- 2022 Section *Topology and Geometry* of the *DMV Annual Meeting* in Berlin.
- since '21 *[K-OS] Knot online seminar*.
- 2021 *Swiss Knots* in Fribourg (member of scientific committee).
- 2021 *Perspectives on quantum link homology theories* in Regensburg.
- '20 – '21 *Regensburg low-dimensional geometry & topology seminar*, online.
- 2019 *Workshop on low-dimensional topology* in Regensburg.
- 2019 *5th Bavarian Geometry & Topology Meeting* in Regensburg.
- 2019 *Swiss Knots* at ETHZ.
- 2017 *Swiss Knots* in Bern.

Service

- '19 – '23 Deputy women's representative of the Faculty of Mathematics in Regensburg.
- since '18 Reviewer for MR.
- '15 – '19 PhD/postdoc delegate at the Faculty of Science in Bern.
- since '14 Referee for various journals.
- since '14 Reviewer for zbMath.
- '11 – '13 Member of the administration of the IMJ's PhD-students.

Selected Talks

Conferences

- 2024 • *Leaning into Topology Workshop* in Pisa (upcoming).
- 2023 • *Oberwolfach Workshop Morphisms in Low Dimensions*.
- 2022 • BIRS Workshop *Using Quantum Invariants to do Interesting Topology* in Oaxaca.
 - *Georgia Topology Conference*, Athens.
 - *Recent developments in link homology theories* at the SwissMAP Research Station.
- 2019 • *Trisections of smooth 4-manifolds* in Matemale.
 - *Knot concordance and low-dimensional manifolds* in Le Croisic.
 - *Workshop on 4-manifolds* at the MPIM.
- 2018 • *Quantum Knot Homology and Supersymmetric Gauge Theories* at the Aspen Center for Physics.
- 2017 • *Quantum topology and categorified representation theory* at the Newton Institute Cambridge.
- 2016 • BIRS Workshop *Synchronizing Smooth and Topological 4-Manifolds*.
- 2015 • Joint AMS-EMS-SPM meeting in Porto.

- 2014 • *Knots in Washington XXXVII*.
- *Topologie géométrique et quantique en dimension 3* at the CIRM.
- Oberwolfach Workshop *Topologie*
- DMV-PTM Joint Meeting in Poznań.
- 2013 • *Swiss Knots* in Bern.
- *Young topology meeting* in London.
- Workshop on *Geometry and topology of smooth 4-manifolds* at the MPIM.

Seminars

- 2023 Geneva.
- 2022 Notre Dame, Göttingen, Zürich, Fribourg.
- 2020 K-OS, CIRGET.
- 2019 IMJ, Bern, Grenoble.
- 2018 Bonn, Basel, Warsaw, Regensburg, Boston College.
- 2017 Marseille, Montpellier, Geneva, University of Zürich, Strasbourg.
- 2016 HIM (Bonn), Regensburg.
- 2015 IMJ, University of Zürich.
- 2014 Tohoku, Bourgogne, MPIM Oberseminar, Aarhus.
- 2013 Geneva, London Geometry and Topology Seminar, Boston College, UC Davis, Joint LA Topology Seminar, Stony Brook, Louvain.

Miscellaneous

Languages: German (native), English (fluent), French (good).

Computer programs:

khoca for computation of \mathfrak{sl}_n knot homologies, see
<https://github.com/LLewark/khoca>.

foamho for computation of \mathfrak{sl}_3 knot homology, see
<http://lewark.de/lukas/foamho.html>.

Various further programs available from
<https://github.com/LLewark>.

Last update: February 2024.