

# Curriculum Vitae

## OSCAR SALOMON KIVINEN

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Date of Birth: October 22, 1992 (Helsinki, Finland)

Date of CV: March 7, 2024

### Education & Employment

9/2023 – **Assistant Professor**, *Aalto University*.

9/2021 – 8/2023 **Researcher**, *EPFL*.

9/2020 – 8/2021 **Postdoctoral fellow**, *University of Toronto*.

7/2019 – 8/2020 **Olga Taussky and John Todd Instructor in Mathematics**, *Caltech*.

9/2015 – 6/2019 **PhD**, Mathematics, *University of California, Davis*.

1/2014 – 6/2014 **MSc**, Engineering Physics, *Aalto University*.

9/2012 – 1/2014 **BSc**, Engineering Physics, *Aalto University*

9/2012 – **Licentiate of Medicine** (Completed some coursework towards the degree), *University of Helsinki*

### Scientific/Academic honors and grants

9/2020 – 6/2021 The Finnish Academy of Science and Letters grant for postdoctoral research abroad

9/2016 – 6/2019 The Vilho, Yrjö and Kalle Väisälä Foundation of the Finnish Academy of Science and Letters grant (25,000e yearly grant for graduate studies)

9/2015 – 4/2018 Departmental fellowship, UC Davis

9/2015 – 6/2020 Fulbright Graduate Grant

5/2014 Aalto University fast graduation award (for completing a BSc+MSc in < 2 years)

7/2010, 7/2011, 7/2012 International Chemistry Olympiad, three medals (2 bronze, 1 silver)

### Publications

#### Papers

1. **Quadratic ideals and Rogers-Ramanujan recursions** (with Yuzhe Bai and Eugene Gorsky), *The Ramanujan Journal* (2018): 1-23.

2. **Hecke correspondences for Hilbert schemes of reducible locally planar curves**, *Algebraic Geometry (Foundation Compositio Mathematica)* 6.5 (2019).

3. **Unramified affine Springer fibers and isospectral Hilbert schemes**, *Selecta Mathematica (New Series)* 26, 61 (2020).

4. **Generalized affine Springer theory and Hilbert schemes on planar curves** (with Niklas Garner), *IMRN*, rnac038, (2022).

5. **Algebra and geometry of link homology** (notes from the 2021 IHÉS summer school, with Eugene Gorsky and José Simental Rodríguez). *Bulletin of the LMS* (2022).

6. Appendix to **Affine Springer fibers, Procesi bundles, and Cherednik algebras** (with Pablo Boixeda Alvarez, Ivan Losev). To appear in *Duke Math. J.*, available at arXiv:2104.09543.

## Preprints

1. **Local Character Expansions and the Link at Infinity.**
2. **The Hilb-vs-Quot conjecture** (with Minh-Tam Trinh). Available at arXiv:2310.19633.
3. **Shalika germs for tamely ramified elements in  $GL_n$**  (with Cheng-Chiang Tsai). Submitted, available at arXiv:2209.02509.
4. **On the affine Springer fibers inside the invariant center of the small quantum group** (with Nicolas Hemelsoet and Anna Lachowska). Submitted, available at arXiv:2205.09700.
5. **The affine Springer fiber-sheaf correspondence** (with Eugene Gorsky and Alexei Oblomkov). Pending revision at *Advances in Math.*, available at arXiv:2204.00303.
6. **Computations for binomial edge ideals and Koszul duality**, December 2014. Available at arXiv:1412.3542.

## Book chapters and manuscripts

1. **Proof of the Hard Lefschetz Theorem** (with Gurbir Dhillon), 2018. Chapter 18 of *Introduction to Soergel bimodules, RSME Springer Series*. (2020)

## Theses

1. **Affine Springer fibers, Hilbert schemes and knots** PhD Thesis, UC Davis, 2019, 104 pages.
2. **Koszul algebras and resolutions** Master Thesis, Aalto University, 2014, 45 pages.
3. **Steady states in chemical reaction networks** Bachelor Thesis, Aalto University, 2014, 20 pages.

## Articles in progress (available on request)

1. **Quot schemes of nonreduced curves and the colored HOMFLY polynomial** (with Dori Bejleri).
2. **Cyclotomic generalized affine Springer fibers** (with José Simental Rodríguez).
3. **From invariant distributions to symmetric functions.**

## Teaching experience

## Aalto University

- 2/2024–4/2024 Lecturer for the course *Algebraic Geometry I* (MS–EV0023).  
 9/2013–12/2015 TA for several courses.

## EPFL

- 9/2022 – 12/2022 TA for the course *Student seminar in pure mathematics* (MATH-563, topic: Knot Theory).  
 1/2022 – 6/2022 Lecturer for the course *Topics in algebraic geometry* (MATH-535).

## University of Toronto

- 9/2020 – 4/2021 Lecturer for the course *Calculus and Linear Algebra for Commerce* (MAT 133Y).

## Caltech

- 1/2020–4/2020 Lecturer for the course *Topics in representation theory* (Math 145b).  
 9/2019–12/2019 Lecturer for the course *Algebraic geometry I* (Math 130a).

## UC Davis

- 10/2018–12/2018 Lecturer for the course *Calculus* (Math 21A).  
 10/2016–12/2016 TA for the course *Algebra* (Math 150A).  
 1/2016–3/2016 TA for the course *Calculus III* (Math 21C)  
 4/2016–6/2016 TA for the course *Ordinary differential equations* (Math 22B).  
 10/2015–12/2015 TA for the course *Calculus I* (Math 21A).

**Invited talks and lectures at conferences or seminars**

- 2023 Mar. **Orbital  $L$ -functions and superpolynomials**, ICMS Conference "The geometry of double affine Hecke algebras and Coulomb branches", Edinburgh.
- Jun. **Some analogs of Hilbert schemes for reductive groups** Representation Theory and Automorphic Forms Seminar, University of Vienna.
- Nov. **The Hilb-vs-Quot conjecture** Geometry and Physics Seminar, Uppsala University.
- 2022 Apr. **The affine Springer fiber-sheaf correspondence** Affine Springer Theory reading group, Hodge institute, University of Edinburgh.
- Apr. **The invariant part of the center of the small quantum group** Workshop on Quantum Geometry, IHÉS. (Video available on the IHÉS YouTube channel.)
- May **Weight polynomials of compactified Jacobians and link invariants** M-Seminar, Kansas State University (virtual). (Video available on the M-Seminar YouTube channel.)
- Jun. **Weight polynomials of compactified Jacobians and link invariants** School 2022: Representation theory and flag or quiver varieties, Paris. (Video available on the school website.)
- Aug. **Local theory of automorphic forms and knot homology** Nordic Congress of Mathematicians 2022, Aalto University. Number theory session.
- Oct. **Old and new geometry for Shalika germs**, Groups, arithmetic and algebraic geometry seminar, EPFL.
- Oct. **3d mirror symmetry and affine Springer fibers**, RIMS Representation Theory seminar, Kyoto.
- Oct. **Old and new geometry for orbital integrals**, Harvard/MIT Algebraic Geometry seminar.
- Oct. **Rational Catalan combinatorics and the small quantum group**, UC Berkeley Combinatorics seminar.
- Oct. **Invariant distributions for  $p$ -adic  $GL_n$  and symmetric functions**, UC Davis Algebraic Geometry seminar.
- Nov. **Unipotent almost characters of  $p$ -adic groups**, Character sheaves on loop groups seminar, Academia Sinica, Taipei.
- Nov. **Old and new methods for Shalika germs**, Séminaire Formes Automorphes, IMJ-PRG.
- Nov. **Old and new methods for Shalika germs**, Séminaire Représentations des Groupes Réductifs, Marseille.
- Dec. **Plane curves: a bridge between knots, number theory and physics**, Algebra and Discrete Math seminar, Aalto University.
- 2021 Jan. **Introduction to generalized affine Springer theory** Ngô Bào Châu's student/postdoc seminar, UChicago (virtual).
- Jun. **Quot schemes and affine flag varieties** Representation Theory and Automorphic Forms, University of Vienna. (Video available at the GRT-home website).
- Jun. **A coherent-constructible correspondence for Hilbert schemes of points** NSF-FRG conference "Categorical braid group actions and categorical representation theory", UMass Amherst. (Video available on the conference website).
- Aug. **Differentials on categorified projectors** AIM research community seminar on  $p$ -dg structures in link homology.
- Oct. **Affine Springer fibers and Hilbert schemes of singular curves I-II** AIM research community seminar on algebraic geometry of link homology.

- Nov. **The sheaf-affine Springer fiber correspondence** Séminaire Groupes, Représentations et Géométrie, IMJ-PRG/Paris 7.
- 2020 Feb. **Triply graded homology of algebraic links and affine Springer theory** ICERM workshop "Soergel bimodules and categorification of the braid group". (Video available on the ICERM website).
- Mar. **Generalized affine Springer theory and homology of algebraic braids.** University of Vienna, representation theory and automorphic forms seminar.
- Jun.  **$\mathbb{Z}$ -algebras from Coulomb branches.** Perimeter Institute/MPIM Bonn, Geometric Representation Theory twinned conference. (Video available on the PI website).
- Oct.  **$p$ -adic orbital integrals and knot invariants.** University of Toronto, Geometric Representation Theory seminar.
- Oct.  **$p$ -adic orbital integrals and knot invariants.** GRT at home seminar, online (video available at the grt-home.org website).
- 2019 Feb. **Commutative algebra related to some affine Springer fibers** Caltech, algebra & geometry seminar.
- Mar. **Commutative algebra related to some affine Springer fibers** MIT, geometric representation theory seminar.
- Nov. **Hilbert schemes: geometry and combinatorics** Caltech, expository lecture in the "pizza course" Ma 20 for undergraduate math majors.
- 2018 Nov. **Lusztig-Yun theory in type A** UC Davis, algebraic geometry seminar.
- Oct. **Hecke correspondences on Hilbert schemes of singular plane curves and knot homology** Johns Hopkins, algebraic geometry seminar.
- Oct. **Unramified affine Springer fibers and isospectral Hilbert schemes** University of Michigan, AMS sectional meeting.
- Sep. **Hilbert schemes and affine Springer fibers** Center for Quantum Geometry of Moduli spaces (QGM), Aarhus, QGM Seminar.
- Jul. **Unramified affine Springer fibers and isospectral Hilbert schemes** (poster presentation). IST Austria, summer school on geometric representation theory.
- Apr. **Springer theory for symmetric spaces in type A** Northeastern University, AMS sectional meeting.
- Mar. **Knots, Hilbert schemes and affine Springer fibers** University of Chicago, algebraic geometry seminar.
- Feb. **Quantization of symplectic resolutions** UC Davis, representation theory seminar.
- Feb. **Hilbert schemes of reducible locally planar curves and Khovanov-Rozansky homology** MSRI, Enumerative geometry beyond numbers postdoc/student seminar.
- 2017 Dec. **Algebraic geometry and knot homologies** Aalto University.
- Nov. **Algebra actions on homology of Hilbert schemes** UC Davis, representation theory seminar.
- May **Positivity of LLT and Macdonald polynomials, after Grojnowski-Haiman** UC Davis, representation theory seminar.
- Apr. **Hilbert schemes of points on locally planar curves** UC Davis, qualifying exam talk.
- 2016 Oct. **Haiman's proof of the  $n!$  and  $(n+1)^{n-1}$  conjectures using Hilbert schemes** UC Berkeley, Macdonald polynomials seminar.
- Apr. **Geometric Langlands for opers after Beilinson-Drinfeld** UC Davis, variation of Hodge Structures, WKB analysis, and quantization seminar course.

- Feb. **Divisors and line bundles on toric varieties** UC Davis, toric varieties reading seminar.  
 2015 Nov. **Knizhnik-Zamolodchikov functors for rational Cherednik algebras** UC Davis, representation theory seminar.  
 2014 Dec. **Koszul algebras and their identification** Aalto University, combinatorics seminar.

### Professional activities

- Along with Anna Beliakova, Anna Lachowska, Louis-Hadrien Robert and Qi You, one of the main organizers of the biennial workshop "Quantum Topology Biennial" in Les Diablerets, Switzerland (first instance in January 2024)
- Along with Francesca Carocci and Sergej Monavari, one of the main organizers of the workshop "Categorified enumerative geometry and representation theory" at the Bernoulli Center, EPFL, September 2023.
- Along with Nicolle Gonzalez, Eugene Gorsky, Matthew Hogancamp, and Alexei Oblomkov, one of the main organizers of the AIM workshop "Algebra, Geometry, and Combinatorics of Link Homology", July 2023.
- Along with NG, EG, MH, AO, one of the main organizers of the AIM research community "Link homology", 2021–
- TA for the course "Algebra and geometry of link homology" at the IHÉS summer school 2021 "Enumerative geometry, physics, and representation theory".
- Visiting researcher at *Institut Henri Poincaré* in Spring 2017. Participant in the program *Combinatorics and Interactions*.
- Reviewed graduate applications for the math department at Caltech in 2019-2020.
- On the candidacy committee of Konrad Pilch (Caltech).
- Refereeing for Duke Math Journal, Algebraic Geometry (Foundation Compositio Mathematica), Representation Theory of the AMS, Transformation groups.
- Reviewer for zbMATH and MathSciNet.
- Department head teaching assistant 2014-2015 at Aalto University. Math tutoring room assistant and main organizer.

### Seminars (co-)organized

- 1/2024– Organizer of the *Algebra and Discrete Math* seminar with Kaie Kubjas at Aalto University.
- 6/2021–6/2022 Co-organizing the algebraic geometry seminar for the AIM research community "Link homology"
- 9/2020–4/2021 Main organizer of the University of Toronto Geometric Representation Theory seminar.
- 9/2019–6/2020 Main organizer of the Caltech Algebra & Geometry seminar.
- 9/2018–12/2018 Reading seminar on mixed Hodge polynomials of wild character varieties.
- 4/2018–6/2018 Reading seminar on noncommutative geometry of the quantum Hall effect (at UC Davis, with Eric Babson, Jerry Kaminker and Alvin Moon)
- 9/2017–12/2017 Knot homology seminar (at UC Davis, with Beibei Liu)
- 9/2017–6/2018 Main organizer of the student algebraic geometry seminar (at UC Davis, with Priya Kshirsagar)
- 1/2017–4/2017 Reading seminar on polygraphs and Macdonald polynomials (at UC Davis/UC Berkeley, with Maria Gillespie)

- 9/2016–12/2016 Reading seminar on combinatorial Hodge theory (at UC Davis, with Federico Castillo and Lang Mou)
- 1/2016–4/2016 Reading seminar on toric varieties (at UC Davis, with Federico Castillo)
- 1/2014–5/2014 Reading seminar on higher categories (at Aalto University, with Emanuele Ventura)

### Conferences and workshops

- 2023 Jun. Helvetic Algebraic Geometry Seminar, SwissMAP Research Station
- 2023 Feb. Non-Archimedean methods in arithmetic and geometry, SwissMAP Research Station
- 2023 Jan. Les Diablerets winter school on mathematical physics, SwissMAP Research Station
- 2022 Aug. Nordic Congress of Mathematicians 28, Aalto University
- 2022 Aug. Gauged maps, vortices, and their moduli, SwissMAP Research Station
- 2022 Jun. School on representation theory of flag or quiver varieties, Paris
- 2022 May. Göran Gustafsson Symposium on Combinatorial Hodge Theory, Institut Mittag-Leffler
- 2022 Apr. Workshop on Quantum Geometry, IHÉS
- 2022 Feb. Vertex algebras and Poisson geometry, SwissMAP Research Station
- 2022 Feb. Recent Advances in Link Homology, SwissMAP Research Station
- 2022 Jan. Les Diablerets winter school on mathematical physics, SwissMAP Research Station
- 2021 Jul. IHÉS summer school "Enumerative geometry, physics, and representation theory"
- 2021 Jun. NSF-FRG conference "Categorical braid group actions and categorical representation theory", UMass Amherst
- 2020 Sep. Strings, knots, symplectic geometry and dualities, Institut Mittag-Leffler
- 2019 Jul. String-math 2019, Uppsala University
- 2018 Oct. AMS Central Sectional Meeting, University of Michigan
- 2018 Oct. Categorified Hecke Algebras, Hilbert Schemes and Link Homology, AIM
- 2018 Aug. WARTHOG 2018: Deligne-Lusztig Theory, University of Oregon
- 2018 Jul. Summer School on Geometric Representation Theory, IST Austria
- 2018 Jun. CIME School on Geometric Representation Theory and Gauge Theories, Cetraro
- 2018 Jun. Southeastern Lie Theory Summer School, UGA
- 2018 May. Representation Theory, Geometry and Quantization (Kostant Memorial Conference), MIT
- 2018 May. Alexander Givental 60th Birthday Conference, UC Berkeley
- 2018 Apr. AMS Northeastern Sectional Meeting, Northeastern University
- 2018 Jan.-May. Enumerative Geometry Beyond Numbers, MSRI
- 2017 Nov. AMS Western Sectional Meeting, UC Riverside
- 2017 Aug. WARTHOG 2017: Koszul duality for Higgs and Coulomb branches, University of Oregon
- 2017 Jul. String-Math 2017, University of Hamburg
- 2017 Jun. Summer School on Soergel Bimodules, MSRI
- 2017 Jun. Workshop on Algebraic Geometry and Physics, SISSA
- 2017 Apr. Scholze lectures on  $p$ -adic geometry, IHÉS
- 2017 Mar. Workshop on Enumerative Geometry, Institut Henri Poincaré
- 2016 Nov. Workshop on Hall Algebras, Enumerative Geometry and Gauge Theory, the Fields Institute
- 2016 Oct. Workshop on Singularities and Motivic Integration, UC Davis

- 2016 Jul. WARTHOG 2016: Hilbert Schemes, Knot Homologies and Cherednik Algebras, University of Oregon
- 2016 Dec. Center for Quantum Mathematics and Physics Inaugural Conference, UC Davis
- 2016 Jun. String-Math 2016, Collège de France
- 2015 Mar. John Coates 70th Birthday Conference, Cambridge
- 2014 Nov. Categorical Structures in Harmonic Analysis, MSRI
- 2014 Jun. Antti Kupiainen 60th Birthday Conference, University of Helsinki
- 2014 Mar. Applications of Real Algebraic Geometry, Aalto University
- 2013 Jun. Summer School on Algebraic Statistics, Nordfjordeid

**Skills**

- Languages Finnish (native), English (fluent/C2), French (B2), Swedish (B1), Spanish (A2), Russian (A1)
- Computer Scala, Python, C, C++, MATLAB, Macaulay2, Sage, Mathematica, Maple, L<sup>A</sup>T<sub>E</sub>X