

Alex Weekes

Curriculum Vitae

1. Personal

Office Address: Department of Mathematics and Statistics
University of Saskatchewan
210 McLean Hall
106 Wiggins Road
Saskatoon, SK S7N 5E6

Email Address: weekes@math.usask.ca

Website: <https://researchers.usask.ca/alex-weekes/>

Citizenship: Canadian

Languages: English (first language), French (intermediate)

2. Employment

2021–present **Assistant Professor**, University of Saskatchewan

2019–2021 **Postdoctoral Fellow**, University of British Columbia
Mentors: Kai Behrend, Jim Bryan, Sabin Cautis

2016–2019 **Postdoctoral Researcher**, Perimeter Institute for Theoretical Physics
Mentor: Alexander Braverman

3. Education

2011–2016 **Ph.D. in Mathematics**, University of Toronto
Supervisor: Joel Kamnitzer
Thesis title: Highest weights for truncated shifted Yangians

May 2015 **Visiting Scholar**, University of Sydney

2010–2011 **M.Sc. in Mathematics**, University of Toronto
Supervisor: Joel Kamnitzer

2006–2010 **Bachelor of Mathematics, with Highest Honours**, Carleton University
Supervisor: Yuly Billig

4. Grants, Honours and Recognitions

- Discovery Grant, NSERC, 2022–2027, \$142,500 CAD
Title: Interactions between representation theory, algebraic geometry, and physics

- New Faculty Start-up Grant, University of Saskatchewan Faculty Recruitment and Retention Fund, 2021–2026, \$50,000 CAD
- Recognized by the University of British Columbia’s Dean of Science for outstanding student evaluations (Summer 2020, Spring 2020, Fall 2019)
- Queen Elizabeth II Graduate Scholarship, Government of Ontario, 2015–2016, \$15,000 CAD
- Ontario Graduate Scholarship, Government of Ontario 2014–2015, \$15,000 CAD
- Alexander Graham Bell Canada Graduate Scholarship, NSERC, 2011–2014, \$105,000 CAD
- Canada Graduate Scholarship (Master’s Program), NSERC, 2010–2011, \$15,000 CAD
- University Medal in Mathematics, Carleton University, 2010
- Undergraduate Summer Research Award, NSERC, 2007–2010, \$4,500 CAD ($\times 4$)

5. Research Interests

Geometric and combinatorial representation theory, algebraic geometry, mathematical physics, quantum algebra, Poisson geometry and integrable systems.

6. Publications

Research publications

1. J. Hilburn, J. Kamnitzer and A. Weekes, *BFN Springer theory*, Communications in Mathematical Physics **402** (2023), 765–832. [arXiv:2004.14998](#).
2. H. Nakajima and A. Weekes, *Coulomb branches of quiver gauge theories with symmetrizers*, Journal of the European Mathematical Society **25** (2023), no. 1, 203–230. [arXiv:1907.06552](#).
3. D. Muthiah and A. Weekes, *Symplectic leaves for generalized affine Grassmannian slices*, Annales scientifiques de l’École normale supérieure **56** (2023), issue 1, 287–298. [arXiv:1902.09771](#).
4. J. Kamnitzer, K. Pham and A. Weekes, *Hamiltonian reduction for affine Grassmannian slices and truncated shifted Yangians*, Advances in Mathematics **399** (2022), article 108281. [arXiv:2009.11791](#).
5. A. Weekes, *Quiver gauge theories and symplectic singularities*, Advances in Mathematics **396** (2022), article 108185. [arXiv:2005.01702](#).
6. D. Muthiah, A. Weekes and O. Yacobi, *The equations defining affine Grassmannians in type A, and a conjecture of Kreiman, Lakshmibai, Magyar, and Weyman*, International Mathematics Research Notices **2022** (2022), issue 3, 1922–1972. [arXiv:1708.06076](#).
7. D. Muthiah, A. Weekes and O. Yacobi, *On a conjecture of Pappas and Rapoport about the standard local model for GL_d* , Journal für die reine und angewandte Mathematik **772** (2021), 175–185. [arXiv:1912.06822](#).

8. I. Halacheva, J. Kamnitzer, L. Rybnikov and A. Weekes, *Crystals and monodromy of Bethe eigenvectors*, Duke Mathematical Journal **169** (2020), no. 12, 2337–2419. [arXiv:1708.05105](#).
9. B. Webster, A. Weekes and O. Yacobi, *A quantum Mirković-Vybornov isomorphism*, Representation Theory **24** (2020), 38–84. [arXiv:1706.03841](#).
10. A. Braverman, M. Finkelberg, J. Kamnitzer, R. Kodera, H. Nakajima, B. Webster and A. Weekes, *Appendix to A. Braverman, M. Finkelberg and H. Nakajima, Coulomb branches of 3d $\mathcal{N} = 4$ quiver gauge theories and slices in the affine Grassmannian*, Advances in Theoretical and Mathematical Physics **23** (2019), no. 1, 75–166. [arXiv:1604.03625](#).
11. A. Tsymbaliuk and A. Weekes, *Appendix to M. Finkelberg and A. Tsymbaliuk, Shifted quantum affine algebras: integral forms in type A*, Arnold Mathematical Journal **5** (2019), no. 1, 75–166. [arXiv:1811.12137](#).
12. J. Kamnitzer, P. Tingley, B. Webster, A. Weekes and O. Yacobi, *On category \mathcal{O} for affine Grassmannian slices and categorified tensor products*, Proceedings of the London Mathematical Society **119** (2019), issue 5, 1179–1233. [arXiv:1806.07519](#).
13. J. Kamnitzer, P. Tingley, B. Webster, A. Weekes and O. Yacobi, *Highest weights for truncated shifted Yangians and product monomial crystals*, Journal of Combinatorial Algebra **3** (2019), vol. 3, 215–236. [arXiv:1511.09131](#).
14. J. Kamnitzer, A. Weekes and D. Muthiah, *On a reducedness conjecture for spherical Schubert varieties and slices in the affine Grassmannian*, Transformation Groups **23** (2018), no. 3, 707–722. [arXiv:1604.00053](#).
15. M. Finkelberg, J. Kamnitzer, K. Pham, A. Weekes and L. Rybnikov, *Comultiplication for shifted Yangians and quantum open Toda lattice*, Advances in Mathematics **327** (2018), 349–389. [arXiv:1608.03331](#).
16. J. Kamnitzer, D. Muthiah, A. Weekes and O. Yacobi, *Reducedness of affine Grassmannian slices in type A*, Proceedings of the American Mathematical Society **146** (2018), 861–874. [arXiv:1611.06775](#).
17. J. Kamnitzer, B. Webster, A. Weekes and O. Yacobi, *Yangians and quantization of slices in the affine Grassmannian*, Algebra and Number Theory **8** (2014), No. 4, 857–893. [arXiv:1209.0349](#).

Preprints submitted for publication

1. D. Muthiah and A. Weekes, *Fundamental monopole operators and embeddings of Kac-Moody affine Grassmannian slices*, [arXiv:2211.04788](#).
2. J. Kamnitzer, B. Webster, A. Weekes and O. Yacobi, *Lie algebra actions on module categories for truncated shifted Yangians*, [arXiv:2203.12429](#).
3. A. Weekes, *Generators for Coulomb branches of quiver gauge theories*, [arXiv:1903.07734](#).

Some articles in preparation

1. With D. Muthiah, *The monopole formula, zastava spaces, and Kac polynomials*.
2. With G. Bellamy, D. Muthiah and O. Yacobi, *Universal deformations of affine Grassmannian slices*.

7. Supervision

Postdoctoral

- 2023–present **Eric Boulter**, co-mentored with Steven Rayan and Curtis Wendlandt, University of Saskatchewan
- 2022–present **Matthew Rupert**, co-mentored with Steven Rayan and Curtis Wendlandt, University of Saskatchewan

Graduate

- 2023–present **Noah Friesen**, *Braid groups and Baxter polynomials*, M.Sc. student co-supervised with Curtis Wendlandt, University of Saskatchewan
- 2022–present **Dat Minh Ha**, *Yangians and Lie bialgebras of affine type*, M.Sc. student co-supervised with Curtis Wendlandt, University of Saskatchewan

Undergraduate

- Summer 2023 **Cesai Li**, *On the monopole formula and its generalizations*, quanTA USRA student, University of Saskatchewan
- Summer 2022 **Thomas Purdy**, *Quantum representation theory via q -Cartan matrices*, quanTA USRA student co-supervised with Curtis Wendlandt, University of Saskatchewan

8. Teaching

- 2023–2024 Winter **Math 266: Linear Algebra II**, University of Saskatchewan
 Fall **Math 362: Rings and Fields**, University of Saskatchewan
 Fall **Math 164: Introduction to Linear Algebra**, University of Saskatchewan
- 2022–2023 Summer **Math 872: Representation Theory and Yangians**, University of Saskatchewan
 Winter **Math 362: Rings and Fields**, University of Saskatchewan
 Fall **Math 872: Hopf Algebras and Quantum Groups**, University of Saskatchewan
 Fall **Math 164: Introduction to Linear Algebra**, University of Saskatchewan
- 2021–2022 Winter **Math 362: Rings and Fields**, University of Saskatchewan
- 2020–2021 Fall **Math 253: Multivariable Calculus**, University of British Columbia
- 2019–2020 Summer **Math 100: Calculus**, University of British Columbia
 Winter **Math 152: Linear Systems**, University of British Columbia
 Fall **Math 253: Multivariable Calculus**, University of British Columbia
- 2017–2018 Fall **MATH 135: Algebra for Honours Mathematics**, University of Waterloo
- 2008–2016 Teaching assistant for MAT133: Calculus and Linear Algebra for Commerce, MAT135: Calculus I, MAT136: Calculus I, MAT186: Calculus I, MAT188: Linear algebra, MAT223: Linear algebra I, MAT224: Linear Algebra II and MAT334: Complex Variables at the University of Toronto; MATH 2100: Algebra II and MATH 2108: Abstract Algebra at Carleton University

9. Professional Activities

Seminar organization

- 2022–present **Co-organizer**, *PIMS Geometry, Algebra, and Physics Seminar*, University of Saskatchewan
- 2016–2019 **Co-organizer**, *Mathematical Physics Seminar*, Perimeter Institute
- May 2018 **Co-organizer**, *MPIM/PI teleseminar on categorified knot invariants*, Max Planck Institute for Mathematics/Perimeter Institute
- 2015–2016 **Co-organizer**, *Geometric Representation Theory Seminar*, University of Toronto/Fields Institute

Committee work

- 2023–present **Member**, *Undergraduate Committee*, Department of Mathematics and Statistics, University of Saskatchewan
- 2023–present **Member**, *Academic Programs Committee (B.Sc. BSMC)*, University of Saskatchewan
- 2022–present **Member**, *Mathematical Physics Program Committee*, University of Saskatchewan
- 2022–2023 **Member**, *Colloquium Committee*, Department of Mathematics and Statistics, University of Saskatchewan

Outreach

- 2022–2023 **Mentor**, *PIMS Virtual Experimental Mathematics Lab*, Pacific Institute for Mathematics
- Spring 2016 **Mentor**, *Math Mentorship Program*, Department of Mathematics, University of Toronto

Referee work

- Advances in Mathematics
- Compositio Mathematica
- International Mathematics Research Notices
- Journal für die reine und angewandte Mathematik
- Journal of the American Mathematical Society
- Progress in Mathematics
- Tohoku Mathematical Journal

Professional Development

- Aug. 2022 **Participant**, *Course Design Institute*, University of Saskatchewan
- March 2021 **Participant**, *Instructional Skills Workshop*, University of British Columbia

10. Selected Invited Talks

Conferences and Workshops

- 2023 Aug. **Centre de Recherches Mathématiques**, Canada-Mexico-US Conference in Representation Theory, Noncommutative Algebra, and Categorification: *Embeddings of Kac-Moody affine Grassmannian slices*
- July **L'Université de Picardie Jules Verne**, Symplectic Singularities and Supersymmetric QFT: *Symplectic singularities, Coulomb branches and affine Grassmannian slices* (4 lecture mini-course)
- Feb. **International Centre for Mathematical Sciences**, The Geometry of Double Affine Hecke Algebras and Coulomb Branches: *Embeddings of Kac-Moody affine Grassmannian slices and fundamental monopole operators*
- 2021 July **International Centre for Theoretical Sciences**, Quantum Fields, Geometry and Representation Theory 2021: *Coulomb branches for quiver gauge theories with symmetrizers*
- 2020 Oct. **Centre de Recherches Mathématiques**, Regional Conference in Lie Theory: *Coulomb branches and Yangians*
- June **Fields Institute**, Workshop on Lie Theory and Integrable Systems in Symplectic and Poisson Geometry: *Quiver gauge theories and symplectic singularities*
- 2019 Dec. **Toronto**, 2019 CMS Winter Meeting: *Deformations of affine Grassmannian slices*
- Aug. **Centre de Recherches Mathématiques**, Quiver varieties and Representation Theory: *Coulomb branches for quiver gauge theories with symmetrizers*
- Mar. **Auburn University**, AMS Spring Sectional Meeting: *Yangians and KLR algebras*
- 2017 Aug. **University of Oregon**, WARTHOG 2017: Symplectic duality (the Abelian case): *The non-Abelian Higgs and Coulomb branches*
- Feb. **Australian National University**, Subfactors and Representation Theory at Kioloa 2017: *An introduction to Nakajima quiver varieties*
- 2016 Oct. **Research Institute for Mathematical Sciences**, Geometric Representation Theory 2016: *Cohomology of quiver varieties, and a conjecture of Hikita*
- Feb. **Banff International Research Station**, Vertex Algebras and Quantum Groups: *Highest weights for some algebras constructed from Yangians*
- 2015 Oct. **Loyola University**, AMS Fall Sectional Meeting: *Truncated shifted Yangians*
- 2013 Nov. **University of Melbourne**, Mini Workshop on Representation Theory in Geometry, Topology and Combinatorics: *Yangians and the affine Grassmannian*

Seminars

- 2023 Feb. **Université de Québec à Montréal**, Séminaire du LACIM: *Quivers, Kac polynomials, and zastava spaces*
- 2021 Aug. **University of Queensland**, What is...? Seminar: *What is the affine Grassmannian?*
- Apr. **University of Queensland**, What is...? Seminar: *What is a Coulomb branch?*

- Mar. **University of Carolina at Chapel Hill**, Geometric Methods in Representation Theory Seminar: *Coulomb branches for quiver gauge theories with symmetrizers*
- Mar. **Kansas State University**, M-Seminar: *Coulomb branches for quiver gauge theories with symmetrizers*
- Jan. **Ohio State University**, Representations and Lie Theory Seminar: *Shifted Yangians and Coulomb branches*
- 2020 May **Imperial College London**: *Quiver gauge theories and symplectic singularities*
- 2019 Oct. **University of British Columbia**, Algebraic Geometry Seminar: *Coulomb branches of 3d $\mathcal{N} = 4$ theories*
- Apr. **Yale University**, Geometry, Symmetry and Physics Seminar: *Coulomb branches of quiver gauge theories with symmetrizers*
- Feb. **University of Toronto/Fields Institute**, Geometric Representation Theory Seminar: *Smoothness of generalized affine Grassmannian slices*
- 2018 Nov. **Ohio State University**, Representations and Lie Theory Seminar: *Yangians and KLR algebras*
- Oct. **Columbia University**, Informal Mathematical Physics Seminar: *Affine Grassmannian slices and their categories \mathcal{O}*
- 2017 Apr. **Ohio State University**, Representations and Lie Theory Seminar: *Highest weights and cohomology rings*
- Mar. **Carleton University**, Ottawa-Carleton Joint Algebra Seminar: *A quantum Mirković-Vybornov isomorphism*
- Feb. **University of Queensland**, Pure Maths Seminar: *Crystals and shift of argument algebras*
- Feb. **University of Sydney**, Algebra Seminar: *Introduction to Coulomb branches (3 lectures)*
- 2016 Feb. **University of Alberta**, Geometry, Algebra, and Physics Seminar: *Yangians and the cohomology of quiver varieties*
- Jan. **Perimeter Institute**, Mathematical Physics Seminar: *Symplectic duality and a presentation of the cohomology of Nakajima quiver varieties*
- 2015 July **École Polytechnique Fédérale de Lausanne**, Geometry Seminar: *Monomial crystals and Yangians*
- Apr. **University of Sydney**, Algebra Seminar: *Quotients of Shifted Yangians*
- Feb. **University of Virginia**, Algebra Seminar: *Representation theory of Yangians*
- 2014 Dec. **Loyola University**, Algebra and Combinatorics Seminar: *Yangians and Nakajima monomial crystals*
- Sep. **University of California, Berkeley**, GRASP Seminar: *Slices in the affine Grassmannian and Yangians*
- Feb. **University of Toronto/Fields Institute**, Geometry Representation Theory Seminar: *Yangians and the affine Grassmannian*
- 2013 Nov. **University of Sydney**, Algebra Seminar: *Shift of argument algebras and the cactus group*