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:	alex.weekes@gmail.com
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

Mentors: Alexander Braverman, Ben Webster

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 (×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. N. Friesen, A. Weekes and C. Wendlandt, *Braid group actions, Baxter polynomials, and affine quantum groups*, to appear in Transactions of the American Mathematical Society. arXiv: 2401.06402.
- 2. D. Muthiah and A. Weekes, Fundamental monopole operators and embeddings of Kac-Moody affine Grassmannian slices, International Mathematics Research Notices (2024), rnae115. arXiv:2211.04788.
- J. Kamnitzer, B. Webster, A. Weekes and O. Yacobi, *Lie algebra actions on module categories for truncated shifted Yangians*, Forum of Mathematics, Sigma 12 (2024), e18. arXiv:2203. 12429.
- J. Hilburn, J. Kamnitzer and A. Weekes, BFN Springer theory, Communications in Mathematical Physics 402 (2023), 765–832. arXiv:2004.14998.
- 5. 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.
- 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.
- 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.

- 8. A. Weekes, Quiver gauge theories and symplectic singularities, Advances in Mathematics **396** (2022), article 108185. arXiv:2005.01702.
- 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.
- D. Muthiah, A. Weekes and O. Yacobi, On a conjecture of Pappas and Rapoport about the standard local model for GL_d, Journal f
 ür die reine und angewandte Mathematik 772 (2021), 175–185. arXiv:1912.06822.
- 11. 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.
- B. Webster, A. Weekes and O. Yacobi, A quantum Mirković-Vybornov isomorphism, Representation Theory 24 (2020), 38-84. arXiv:1706.03841.
- 13. 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 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.
- 14. 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.
- J. Kamnitzer, P. Tingley, B. Webster, A. Weekes and O. Yacobi, On category O for affine Grassmannian slices and categorified tensor products, Proceedings of the London Mathematical Society 119 (2019), issue 5, 1179–1233. arXiv:1806.07519.
- 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.
- 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.
- 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.
- 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.
- 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. A. Weekes, Generators for Coulomb branches of quiver gauge theories, arXiv:1903.07734.

Selected 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 Poisson deformations of affine Grassmannian slices.

7. Supervision

Postdoctoral

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

Graduate

- 2024–present **Noah Friesen**, Ph.D. student co-supervised with Curtis Wendlandt, University of Saskatchewan
- 2022–2024 **Noah Friesen**, *Braid groups and Baxter polynomials*, M.Sc. student co-supervised with Curtis Wendlandt, University of Saskatchewan
- 2022-2024 **Dat Minh Ha**, On a class of extended toroidal Lie algebras coming from untwisted affine Yangians, M.Sc. student co-supervised with Curtis Wendlandt, University of Saskatchewan

Undergraduate

- Summer 2024 Sam Hillis, Casimir elements and the equations defining Lie groups, quanTA USRA student, University of Saskatchewan
- Summer 2024 Elizabeth McGrath, Equations of nilpotent orbits in arbitrary characteristic, quanTA USRA student, University of Saskatchewan
- 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

2024-2025	Winter	Math 164: Introduction to Linear Algebra, University of Saskatchewan
		Math 362: Rings and Fields, University of Saskatchewan
	Fall	Math 364: Number Theory, University of Saskatchewan
2023-2024	Winter	Math 266: Linear Algebra II, University of Saskatchewan
		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 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 Winter Fall	 Math 100: Calculus, University of British Columbia Math 152: Linear Systems, University of British Columbia 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

Conference organization

- April 2025 **Co-organizer**, Symplectic Singularities, Supersymmetric QFT, and Geometric Representation Theory, Simons Center
- June 2024 **Co-organizer**, Representation Theory and Geometry of Affine Quantum Groups, Special session during the 2024 CMS Summer Meeting, University of Saskatchewan

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 , <i>Geometric Representation Theory Seminar</i> , University of Toronto/Fields Institute

Committee work

2024–present	Member, NSERC USRA Adjudication Committee, University of Saskatchewan
2023–present	Chair, Academic Programs Committee (B.Sc. BSMC), University of Saskatchewan
Fall 2023	Member , <i>Salary Review Committee</i> , Department of Mathematics and Statistics, University of Saskatchewan
2022–present	Member, Mathematical Physics Program Committee, University of Saskatchewan

2022-2023	Member , <i>Colloquium Committee</i> , Department of Mathematics and Statistics, University of Saskatchewan
Outreach	
2022-2023	Mentor , <i>PIMS Virtual Experimental Mathematics Lab</i> , Pacific Institute for Mathematics
Spring 2016	Mentor, Math Mentorship Program, Department of Mathematics, University of Toronto

Referee work

I have referred submissions for the following journals:

- 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
- Transformation Groups

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

- 2024 June **Beijing Institute of Technology**, Conference on Representation Theory, Geometry and Categorification: *Embeddings of affine Grassmannian slices via Coulomb branches*
 - June **Beijing Institute of Technology**, Summer School on Representation Theory, Geometry and Categorification: *Affine Grassmannian slices and Coulomb branches* (4 lecture mini-course)
- 2023 Nov. **UNC Chapel Hill**, Workshop on Geometric Representation Theory and Moduli Spaces: Affine Grassmannians, Coulomb branches, and closed embeddings
 - 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