

# Edward L. Richmond

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## Education:

- University of North Carolina - Chapel Hill, NC  
Ph.D, Mathematics (May 2008)  
Advisor: Prakash Belkale  
Thesis title: Recursive structures in the cohomology of flag varieties
  - Colgate University - Hamilton, NY  
BA, Mathematics, with honors (May 2000)
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## Research Interests:

I am interested in algebraic combinatorics, algebraic geometry, representation theory and Lie theory. In particular, I work with geometric and algebraic aspects of Schubert varieties, flag varieties, Coxeter groups and related topics.

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## Appointments:

- Associate Professor, Oklahoma State University, Stillwater, OK (Fall 2019-present)
  - Assistant Professor, Oklahoma State University (Fall 2013-Spring 2019)
  - Graduate Director of Mathematics, Oklahoma State University (Fall 2018-present)
  - Learning and Teaching Fellow, University of British Columbia - Vancouver, BC (Fall 2013 - Spring 2014)
  - Visiting postdoctoral researcher, ICERM - Providence, RI (Spring 2013)
  - Postdoctoral Fellow, University of British Columbia - Vancouver, BC (Fall 2010 - Spring 2013)
  - Visiting Assistant Professor, University of Oregon - Eugene, OR (Fall 2008 - Spring 2010)
  - Teaching Fellow, UNC - Chapel Hill, NC (Fall 2002 - Spring 2008)
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## Grants and Awards:

- OSU College of Arts & Sciences Summer Research Program award (Summer 2019). Amount: One month summer salary + \$ 1,000 towards travel.
- Collaborate@ICERM workshop “The geometry of Nash blowups of Schubert varieties, fiber products of resolutions, and Peterson translation” (Summer 2019). CoPIs: Dave Anderson (Ohio State), Laura Escobar (Wash U. in St. Louis), William Slofstra (Waterloo), Alex Woo (Idaho). Amount: Travel support for each PI.
- Collaborate@ICERM workshop “Hyperplane arrangements, Peterson translation and the Nash blowup of a Schubert variety” (Summer 2017). CoPIs: Jim Carrell (UBC), William Slofstra (Waterloo), Alex Woo (Idaho). Amount: \$1,359.36 for each PI.

- Koslow Research Experience Faculty Mentor Award (Student: Tim Alland) (2017): Amount: \$1,000.
- NSA Young Investigators grant “Combinatorics and geometry of Schubert varieties” (2016-2018). Amount: \$40,000.
- OSU Deans Incentive Grant (2015, 2016). Amount: \$3,000 each year.

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**Refereed Publications:**

1. *A partial Horn recursion in the cohomology of flag varieties.*  
*J. Algebraic Combin.* 30 (2009), 1-17.
2. *Branching Schubert calculus and the Belkale-Kumar product on cohomology.*  
with N. Ressayre, *Proc. Amer. Math. Soc.* 139 (2011), no. 3, 835-848.
3. *A multiplicative formula for structure constants in the cohomology of flag varieties.*  
*Michigan Math. J.* 61 (2012), no. 1, 3-17.
4. *The Belkale-Kumar cup product and relative Lie algebra cohomology. (Appendix)*  
with S. Evens. and W. Graham, *Int. Math. Res. Not.* 2013 (2013), 1901-1933.
5. *Eigenvalues of hermitian matrices and equivariant cohomology of Grassmannians.*  
with D. Anderson and A. Yong, *Compositio Math.* vol 149 (2013), 1569-1582.
6. *Rationally smooth elements of Coxeter groups and triangle group avoidance.*  
with W. Slofstra, *J. Algebraic Combin.* 30 (2014), no. 39, 659-681.
7. *A combinatorial characterization of tight fusion frames.*  
with M. Bownik and K. Luoto, *Pacific J. Math.* vol 275 (2015), no. 2, 257294.
8. *Littlewood-Richardson coefficients for reflection groups.*  
with A. Berenstein, *Advances in Math.* vol 284 (2015), 22, 54-111.
9. *Billey-Postnikov decompositions and the fibre bundle structure of Schubert varieties.*  
with W. Slofstra, *Math. Ann.* vol 366 (2016), 1-2, 31-55.
10. *Staircase diagrams and the enumeration of smooth Schubert varieties.*  
with W. Slofstra, *J. Comb. Th. Series A.* vol 150 (2017), 328-376.
11. *Pattern avoidance and fiber bundle structures on Schubert varieties.*  
with T. Alland, *J. Comb. Th. Series A.* vol 154 (2018), 533-550.
12. *Smooth Schubert varieties in the affine flag variety of type A.*  
with W. Slofstra, *European J. of Combin.* vol 71 (2018), 125-138.
13. *The Nash blow-up of a cominuscule Schubert variety.*  
with W. Slofstra and A. Woo, *J. Algebra.* vol 559 (2020), 580-600.
14. *Noncommutative LR coefficients and crystal reflection operators.*  
with V. Tewari, *Algebr. Comb.* vol 4, no 1 (2021), 145-162.
15. *An equivariant basis for the cohomology of Springer fibers.*  
with M. Precup, *Trans. Amer. Math. Soc., Series B.* no. 8 (2021), 481-509.

**Preprints:**

16. *The isomorphism problem for Schubert varieties.*  
with W. Slofstra, submitted.
17. *On the generating function for intervals in Young’s lattice.*  
with F. Azam, submitted.

**Conference Proceedings:**

18. *Staircase diagrams and the enumeration of smooth Schubert varieties.*  
with W. Slofstra, Proceedings of the 28th annual Conference on FPSAC (2016).  
(this is an alternate version of the paper above of the same name).
  19. *A noncommutative geometric LR rule.*  
with V. Tewari and S van Willigenburg, Proceedings of the 28th annual Conference on FPSAC (2016).
  20. *Pattern avoidance and fiber bundle structures on Schubert varieties.*  
with T. Alland, Proceedings of the 29th annual Conference on FPSAC (2017).  
(this is an alternate version of the paper above of the same name).
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**Editorial work:**

- *Handbook of Combinatorial Algebraic Geometry: Subvarieties of the Flag Variety.*  
with E. Insko and M. Precup. CRC Press. Expected publication date: April 2024.
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**Teaching Experience at the Oklahoma State University:**

- Topics in Algebraic Combinatorics (Math 5010) - Fall 2017, 2021
  - Research Methods (Math 3933) - Spring 2016, 2017, 2018
  - Intro to Modern Algebra (Math 3613) - Fall 2015, 2018
  - Linear Algebra (Math 3013) - Fall 2015, 2017, 2019, 2020, Spring 2015, 2018
  - Calculus II (Math 2153) - Fall 2014, 2016, 2018, Spring 2017
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**Ph.D. Advising:**

1. Travis Grisby, expected graduation 2023.
2. S.M. Faqrudin Azam, expected graduation 2023.

**M.S. Advising:**

1. Isaiah DeHoyos, graduated 2021 (currently a Ph.D. student at OSU).
2. Ajeeth Gunna Reedy, graduated 2019 (currently a Ph.D. student at the University of Melbourne).

**Undergraduate Advising:**

1. Tim Alland, graduated 2017 (currently in Ph.D. program at SUNY Stony Brook).

**Student committee member:**

1. MS committee member for Nina Williams (g. 2018), William Davis (g. 2019), Rajan Adhikari (g. 2019).
2. Ph.D. committee member for Scott Larson (g. 2020), Maiko Serizawa (University of Ottawa, outside member) (g. 2021), Rose Uscanga (g. 2021), Adam Cartisano, April Richardson, Nina Williams and Courtney Miller (College of Education, outside member),.

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**Research Talks (since 2015):**

- Discrete Math seminar, Texas State University, San Marcos, TX, April 2022 (virtual).
- Algebra seminar, University of Georgia, Athens, GA, March 2022.
- Colloquium, University of Georgia, Athens, GA, March 2022.
- AMS Eastern Sectional Meeting, Tufts University - Medford, MA, March 2022 (virtual).
- Combinatorics seminar, Washington University in St. Louis - St. Louis, MO, February 2022.
- Lie Theory seminar, Oklahoma State University - Stillwater, OK, August 2021.
- Schubert Seminar series, ICERM - Providence, RI, March 2021 (virtual).
- AMS Northeastern Sectional Meeting, Tufts University - Medford, MA, March 2020 (canceled due to pandemic).
- Algebraic Combinatorics seminar, University of Waterloo - Waterloo, ON, February 2020.
- Discrete Math seminar, Arizona State University - Tempe, AZ, January 2020.
- Lie Theory seminar, Oklahoma State University - Stillwater, OK, September 2019.
- Combinatorics seminar, Washington University in St. Louis - St. Louis, MO, February 2019.
- Algebra seminar, Virginia Tech - Blacksburg, VA, December 2018.
- Algebra seminar, University of Oklahoma - Norman, OK, October 2018.
- Combinatorics seminar, University of Washington - Seattle, WA, April 2018.
- Graduate seminar, Oklahoma State University - Stillwater, OK, March 2018
- Lie Theory seminar, Oklahoma State University - Stillwater, OK, January 2018.
- Geometry, combinatorics and Integrable systems seminar, Ohio State University - Columbus, OH, September 2017.
- Algebra and combinatorics seminar, Oklahoma State University - Stillwater, OK, September 2017.
- AMS Central Sectional Meeting, University of North Texas - Denton, TX, September 2017.
- 2017 Formal Power Series and Algebraic Combinatorics Conference - London, UK, July 2017.
- Algebra and combinatorics seminar, Oklahoma State University - Stillwater, OK, February 2017.
- 2016 Formal Power Series and Algebraic Combinatorics Conference - Vancouver, BC, July 2016.
- AMS Western Sectional Meeting, University of Utah - Salt Lake, UT, April 2016.
- Lie Theory seminar, Oklahoma State University - Stillwater, OK, May 2015.
- Combinatorics seminar - University of Illinois - Urbana, IL, April 2015.
- Southwest Local Algebra Meeting - Oklahoma State University - Stillwater, OK, March 2015.
- Number Theory seminar, Oklahoma State University - Stillwater, OK, January 2015.
- AMS-MAA Joint Meetings 2015 - San Antonio, TX, January 2015.

### **Non-Research Talks:**

- Cameron University Math seminar series, Lawton, OK, April 2022 (virtual).
  - OSU Lie theory reading seminar - Intersection homology - Stillwater, OK, 6 lectures, Fall 2021.
  - OSU High School Math contest speaker - Stillwater, OK, October 2018.
  - Stillwater High School math club - Stillwater, OK, February 2018.
  - Stillwater High School math club - Stillwater, OK, April 2017.
  - OSU math club - Stillwater, OK, October 2015.
  - Stillwater High School math club - Stillwater, OK, September 2015.
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### **Academic Service (since 2015):**

- Referee for Algebraic Combinatorics, Communications in Algebra, Electronic Journal of Combinatorics, Indagationes Mathematicae, Journal of Algebra, Journal of Algebraic Combinatorics, Journal of the American Mathematical Society, Pure and Applied Mathematics Quarterly, Selecta Mathematica, and Transformation Groups. Also reviewer for Math Reviews. Also provided quick opinion for Journal of London Mathematics Society.
  - Co-organizer for a special session on Combinatorial Lie theory at the AMS Southeastern Section meeting in Gainesville, FL, November 2-3, 2019.
  - Co-organizer for a panel discussion on The Experiences of Foreign Graduate Students as GTAs at the AMS-MAA Joint meetings in San Diego, CA, January 12, 2018.
  - Co-organizer of the OK-LSAMP Bridge to the Doctorate summer workshop, May 2017, 2018.
  - Co-instructor for the OK-LSAMP online course 2017-2018.
  - Co-organizer for a special session on Flag varieties at the AMS Central Section meeting in Denton, TX, September 9-10, 2017.
  - Co-organizer for a special session in Algebraic Combinatorics at the AMS Western Section meeting in Salt Lake, UT, April 9-10, 2016.
  - AMS-MAA Joint Committee on Teaching Assistants and Part-Time Instructors - 2016-2019.
  - Master of Ceremonies for the team competition at OSU Math Day for high school students, October 2015, 2016, 2017.
  - Graduate committee, OSU - 2018-2019 (chair), 2019-2020 (chair), 2020-2021 (chair).
  - Personnel committee, OSU - 2017-2018, 2019-2020 (chair), 2020-2021.
  - Putnam committee, OSU Fall 2015, 2017.
  - Undergraduate committee, OSU - 2015-2016.
  - Appointments committee, OSU - 2014-2015.
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