

# Curriculum Vitae

## NOAH SNYDER

Office Address: Mathematics Department, Indiana University  
Bloomington, IN 47405  
nsnyder@gmail.com,

Date of Birth: 1980, Pennsylvania, USA

### Employment/Education:

- 2020 **Lead Organizer**, MSRI Quantum Symmetries Program
- 2017 – **Associate Professor**, Indiana University
- 2013 – 2017 **Assistant Professor**, Indiana University
- 2012 **Visiting Scientist**, Max Planck Institute for Mathematics
- 2009 – 2012 **NSF Postdoctoral fellow**, Columbia University  
Sponsoring scientist: Dylan Thurston
- 2002 – 2009 **Ph.D. in Mathematics**, University of California, Berkeley  
Advisor: Nicolai Reshetikhin  
Thesis: “Quantum groups, tensor categories, and knot invariants”
- 1998 – 2002 **A.B.**, Harvard College, *magna cum laude with highest honors in Mathematics*  
Advisor: Benedict Gross

### Scientific/Academic Honors and Grants:

- 2020 – 2023 NSF grant DMS-2000093, Subfactors, tensor categories, and higher dimensional algebra, PI, \$258,456
- 2016 Indiana University Bloomington Outstanding Junior Faculty
- 2016 Indiana University Trustees’ Teaching Award
- 2015 – 2020 NSF CAREER grant DMS-1454767, Subfactors, Tensor Categories, and Local Topological Field Theory, PI, \$455,281
- 2011 – 2014 NSF grant DMS-1135049, Canada/USA Mathcamp: Research in pairs and scholarships for students, co-PI, \$76,608
- 2009 – 2012 National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship
- 2002 – 2006 National Science Foundation Graduate Research Fellowship

### Research Interests:

Quantum groups, tensor categories, low-dimensional topology, and subfactors.

### Publications and Preprints:

Peer-reviewed journal articles

1. *The Extended Haagerup fusion categories* Joint with P. Grossman, S. Morrison, D. Penneys, and E. Peters. Accepted by **Annales scientifiques de l’École normale supérieure**. arXiv:1810.06076
2. *A quick route to unique factorization in quadratic orders*. Joint with P. Pollack. **Amer. Math. Monthly** 128 (2021), no. 6, 554–558. arXiv:2010.05033.
3. *Invertible braided tensor categories* Joint with A. Brochier, D. Jordan, and P. Safronov. **Algebr. Geom. Topol.** 21 (2021), no. 4, 2107–2140. arXiv:2003.13812

4. *On dualizability of braided tensor categories* Joint with A. Brochier and D. Jordan. **Compos. Math.** 157 (2021), no. 3, 435–483. [arXiv:1804.07538](#)
5. *Dualizable tensor categories.* Joint with C. Douglas and C. Schommer-Pries. **Mem. Amer. Math. Soc.** 268 (2020), no. 1308, vii+88 pp. [arXiv:13127188](#).
6. *The balanced tensor product of module categories.* Joint with C. Douglas and C. Schommer-Pries. **Kyoto J. Math.** 59 (2019), no. 1, 167–179. [arXiv:1312.7188](#)
7. *The Asaeda–Haagerup fusion categories* Joint with P. Grossman and M. Izumi. **J. Reine Angew. Math.** 743 (2018), 261–305. [arXiv:1501.07324](#)
8. *Categories generated by a trivalent vertex.* Joint with S. Morrison and E. Peters. **Selecta Math. (N.S.)** 23 (2017), no. 2, 817–868 (with S. Morrison and E. Peters).
9. *On cubes of Frobenius extensions.* Joint with Elias and Williamson. Representation Theory-Current Trends and Perspectives (Eds: Henning Krause, Peter Littelmann, Gunter Malle, Karl-Hermann Neeb and Christoph Schweigert), 171–186. [arXiv:1308.5994](#)
10. *Mednykh’s Formula via Lattice Topological Quantum Field Theories*. Proceedings of the 2014 Maui and 2015 Qinhuangdao conferences in honour of Vaughan F. R. Jones’ 60th birthday, 389–398, Proc. Centre Math. Appl. Austral. Nat. Univ., 46, Austral. Nat. Univ., Canberra, 2017. [arXiv:0703073](#)
11. *The Brauer–Picard groupoid of the Asaeda–Haagerup categories* Joint with P. Grossman. **Transactions of the American Mathematical Society** 368 (2016), no. 4, 2289–2331. [arXiv:1202.4396](#).
12. *Cyclic extensions of fusion categories via the Brauer–Picard groupoid.* Joint with P. Grossman and D. Jordan. **Quantum Topology** 6 (2015), no. 2, 313–331. [arXiv:1211.6414](#)
13. *Subfactors of index exactly 5* Joint with M. Izumi, S. Morrison, D. Penneys, and E. Peters. **Bulletin of the London Mathematical Society** 47 (2015), no. 2, 257–269. [arXiv:1406.2389](#).
14. *The classification of subfactors of index at most 5.* Joint with V. Jones and S. Morrison. **Bulletin of the American Mathematical Society** 51 (2014), 277–327. [arXiv:1304.6141](#)
15. *A rotational approach to triple point obstructions.* **Analysis & PDE** 6 (2013) 1923–1928. [arXiv:1207.5090](#)
16. *Subfactors of index less than 5, part 3: quadruple points.* **Communications in Mathematical Physics** 316 (2012), no. 2, 531–554. Joint with M. Izumi, V. Jones, and S. Morrison. [arXiv:math/1109.3190](#)
17. *Constructing the extended Haagerup planar algebra.* Joint with S. Bigelow, S. Morrison, and E. Peters. **Acta Mathematica** 209 (2012), no. 1, 29–82. [arxiv:0909.4099](#)
18. *Non-cyclotomic fusion categories.* Joint with S. Morrison. **Transactions of the American Mathematical Society** 364 (2012), no. 9, 4713–4733. [arXiv:1002.0168](#)
19. *Subfactors of index less than 5, part 1: the principal graph odometer.* Joint with S. Morrison. **Communications in Mathematical Physics** 312 (2012), no. 1, 1–35. [arXiv:1007.1730](#)
20. *Quantum subgroups of the Haagerup fusion categories.* Joint with P. Grossman. **Communications in Mathematical Physics** 311 (2012), no. 3, 617–643. [arXiv:1102.2631](#)

21. *Subfactors of index less than 5, part 2: quadratic tangles and triple points.* Joint with S. Morrison, D. Penneys, and E. Peters. **International Journal of Mathematics** 23 (2012), no. 3, 1250016, 33 pp. arXiv:1007.1730
22. *Cyclotomic integers, fusion categories, and subfactors.* Joint with F. Calegari and S. Morrison. **Communications in Mathematical Physics** 303 (2011), no. 3, 845–896. arxiv:1004.0665
23. *Knot polynomial identities and quantum group coincidences,* **Quantum Topology** 2 (2011), no. 2, 101–156 (with S. Morrison and E. Peters). arxiv:1003.0022
24. *Skein theory for the  $D_{2n}$  planar algebras.* Joint with S. Morrison and E. Peters. **Journal of Pure and Applied Algebra** 214 (2010), no. 2, 117–139. arxiv:0808.0764
25. *The half-twist for  $U_q(\mathfrak{g})$  representations.* Joint with P. Tingley. **Algebra & Number Theory** 3 (2009), no. 7, p. 809–834. arxiv:0810.0084
26. *Groups with a character of large degree,* **Proceedings of the American Mathematical Society** 136 (2008), no. 6, 1893–1903. arXiv:math/0603239
27. *Cartan subalgebras of root-reductive Lie algebras.* Joint with E. Dan-Cohen and I. Penkov. **Journal of Algebra** 308 (2007), no. 2, 583–611. arXiv:math/0603004
28. *An alternate proof of Mason’s theorem,* **Elemente Mathematik** 55 (2000), no. 3, 93–94.

## ArXiv preprints

29. *Graded extensions of generalized Haagerup categories* Joint with P. Grossman and M. Izumi, submitted to **Pure and Applied Mathematics Quarterly** special issue on Subfactors and Related Topics in memory of Vaughan Jones. 52 pages. arXiv:2201.11901
30. *Kashaev-Reshetikhin Invariants of Links* Joint with K.-C. Chen, C. McPhail-Snyder, and S. Morrison, submitted to **Journal of Knot Theory and its Ramifications**. 24 pages. arXiv:2108.06561.

## Work in Progress

31. *Dualizable tensor categories II: Homotopy  $SO(3)$  actions.* Joint with C. Douglas and C. Schommer-Pries.
32. *Towards a quantum exceptional series.* Joint with S. Morrison and D. Thurston.
33. *Small algebras in spherical tensor categories.* Joint with D. Penneys
34. *Temperley-Lieb-Jones bimodule categories and bi-invertible connections.* Joint with D. Penneys and E. Peters.
35. *Tilting modules for quantum  $G_2$  at roots of unity and Kuperberg’s spider.* Joint with V. Ostrik.

## Invited Lectures:

- 2022 May **University of Edinburgh, Hodge Seminar:** *String diagrams and explicit descriptions of homotopy groups.*
- 2021 Sep. **Oberwolfach: Quantum Groups - Algebra, Analysis and Category Theory:** *A strange fiber functor.*
- 2021 Oct. **University of Massachussets, Representation Theory Seminar:** *String diagrams and explicit descriptions of homotopy groups..*

- 2020 Apr. **UC Davis:** *The Exceptional Knot Polynomial.*
- 2020 Mar. **MSRI:** **Tensor categories and topological quantum field theories:** *What is a homotopy coherent  $SO(3)$  action on a 3-groupoid?*
- 2019 Oct. **Oberwolfach:** **Subfactors and Applications:** *Module categories and graph planar algebras*
- 2019 Jul. **CIMPA:Research School on Quantum Symmetries:** *Topological Quantum Field Theory.* (Lecture series.)
- 2019 Jun. **ICMS:** **Geometric representation theory and low-dimensional topology:** *Local topological field theories with values in Morita categories*
- 2019 Mar. **Midwest homotopy type theory seminar:** *The encode/decode method for mathematicians.*
- 2018 Oct. **Banff** (Fusion Categories and Subfactors): *The Morita equivalence class of the Extended Haagerup fusion categories and Graph Planar Algebra embeddings*
- 2018 Jun. **CIRM** (Representation Theory, Mathematical Physics and Integrable Systems): *Exceptional Fusion Categories*
- 2018 May **University of Edinburgh** (MAXIMALS): *Exceptional Fusion Categories*
- 2018 Mar. **Australia National University:** *The  $SO(3)$  action on the space of finite tensor categories*
- 2018 Mar. **Australia National University:** *Quantum  $G_2$  at roots of unity: diagrams vs. algebra*
- 2017 Nov. **The Ohio State University** (Colloquium): *Simple skein theories*
- 2017 Oct. **University of Oregon** (Algebra seminar): *Simple skein theories*
- 2017 Jul. **Maui** (Quantum Symmetries conference): *Algebraic version of small index subfactor classification*
- 2017 May **Indiana University** (AMS special session): *Trivalent categories*
- 2017 Feb. **Notre Dame** (Topology seminar): *The  $SO(3)$  action on the space of finite tensor categories*
- 2017 Feb. **Oxford University** (Topology seminar): *The  $SO(3)$  action on the space of finite tensor categories*
- 2017 Feb. **Glasgow University** (Analysis seminar): *Factors, bimodules, and fusion categories*
- 2017 Jan. **Cardiff University** (GAPT seminar): *Subfactors and their classification*
- 2017 Jan. **Isaac Newton Institute** (Structure of operator algebras): *Trivalent categories*
- 2017 Jan. **Joint math meetings** (special session): *Trivalent categories*
- 2016 Sep. **The Ohio State University** (Quantum algebra and quantum topology seminar): *Radford's theorem and the belt trick*
- 2016 Aug. **Oaxaca** (Modular categories): *Topological field theory and modular tensor categories*
- 2016 Jul. **University of Edinburgh** (MAXIMALS seminar): *The exceptional knot polynomial*
- 2016 Feb. **Vanderbilt University** (Subfactor seminar): *The exceptional knot polynomial.*
- 2016 Feb. **Purdue Colloquium:** *Subfactors and their classification*
- 2015 Oct. **UCSD** (WCOAS): *A new understanding of the Asaeda-Haagerup subfactor*
- 2015 Sep. **Banff** (Nichols Algebras): *Exotic fusion categories and the classification of small index subfactors*
- 2015 Mar. **Oberwolfach** (Subfactors and Conformal Field Theory): *Does the Asaeda-Haagerup subfactor come from a CFT?*
- 2015 Feb. **University of Iowa Colloquium:** *Local topological field theory and fusion categories*

- 2015 Jan. **IPAM** (Symmetry and Topology in Quantum Matter): *Local TFTs and tensor categories*
- 2014 May **University of Edinburgh**: *Local topological field theory and fusion categories*
- 2014 Mar. **University of Erlangen**: *Radford's theorem for finite tensor categories*
- 2014 Jan. **Joint meetings**: *The Brauer-Picard groupoid of the Asaeda-Haagerup subfactor*
- 2013 Oct. **DARPA and Shanks workshop**: *The space of fusion categories*
- 2013 Jul. **Subfactors in Maui**: *Small index subfactors: how strange are they?*
- 2013 May **Université de Bourgogne (Workshop on fusion categories)**: *Radford's theorem and the belt trick*
- 2013 Mar. **Australia National University**: *The space of fusion categories.*
- 2013 Mar. **IPMU Tokyo** (winter school): *Dualizable tensor categories*
- 2013 Feb. **Northwestern University** (Algebra seminar): *The space of fusion categories*
- 2012 Dec. **Utrecht University Colloquium**: *Algebra in higher dimensions*
- 2012 Nov. **Bonn University** (Representation theory seminar): *Knot polynomial identities and quantum group coincidences*
- 2012 Nov. **Oxford University** (Topology seminar): *Radford's theorem and the belt trick*
- 2012 Nov. **Max Planck Institute** (Geometric topology seminar): *Local Topological Field Theory and Fusion Categories*
- 2012 Nov. **Göttingen** (Kolloquium des Graduiertenkollegs): *Small fusion categories and subfactors*
- 2012 Oct. **KU Leuven** (Operator algebra seminar): *Subfactors and Semisimple algebras*
- 2012 July **Subfactors in Maui**: *Intermediate subfactors*
- 2012 May **NCGOA Conference**: *Classifying all algebras in a given fusion category*
- 2012 Feb. **University of Toronto Colloquium**: *Semisimple algebras and subfactors*
- 2012 Jan. **Washington University Colloquium** : *Semisimple algebras and subfactors*
- 2012 Jan. **Vanderbilt University Colloquium** : *Subfactors and the standard invariant*
- 2012 Jan. **University of Oregon Colloquium** : *Semisimple algebras and subfactors*
- 2012 Jan. **Indiana University Colloquium** : *Semisimple algebras in tensor categories*
- 2012 Jan. **Joint Meetings**: *3-dimensional topology and finite tensor categories*
- 2011 Dec. **Courant Institute** (Geometry seminar): *Local topological field theory and fusion categories*
- 2011 Nov. **Purdue** (Topology seminar): *Local topological field theory and fusion categories*
- 2011 Oct. **Vanderbilt** (Subfactor seminar): *The Brauer Group and Subfactors*
- 2011 Jul. **Maui Subfactor Conference**: *Small index subfactors: part 3*
- 2011 Mar. **Vanderbilt** (Subfactor seminar): *Applications of Number Theory to Subfactors*
- 2011 Mar. **Vanderbilt Colloquium**: *Finite Quantum Groups*
- 2010 Nov. **Kyoto University**: *The Arithmetic of Fusion Categories and Subfactors*
- 2010 Apr. **Macalester College** (Quantum Invariants of 3-manifolds and Modular Categories): *How to recognize  $U_q(\mathfrak{g}_2)$  or  $S_t$ .*
- 2010 Feb. **U.C. Berkeley** (Subfactor Seminar): *Cyclotomic Integers and Subfactors.*
- 2010 Feb. **Vanderbilt** (Subfactors and Fusion Categories Workshop): *The extended Haagerup planar algebra and the classification of small index subfactors.*
- 2009 Oct. **Baylor** (Fusion categories and applications): *Small fusion categories and subfactors.*

- 2009 Sep. **Columbia** (Geometric Topology Seminar): *Knot polynomial identities and coincidences of small quantum groups.*
- 2009 Mar. **University of Indiana** (Modular Categories and Applications ): *Coincidences of tensor categories.*
- 2009 Jan. **Joint Meetings:** *Invariants of knots with flat connections in the complement*
- 2008 Nov. **U.C. Berkeley** (Representation Theory, Geometry, and Combinatorics): *Quantum Analogues of Finite Groups*
- 2008 Oct. **U.C. Berkeley** (Topology Seminar): *Knot invariants and the  $D_{2n}$  planar algebras*
- 2008 Apr. **Vanderbilt** (Subfactors and Planar Algebras Workshop): *Unoriented or disoriented?*
- 2007 Dec. **Wellington, New Zealand** (joint AMS/NZMS meeting): *The ribbon half-twist*
- 2007 Nov. **U.C. Santa Barbara** (Station Q): *Kashaev-Reshetikhin knot invariants*
- 2007 Nov. **U.C. Santa Barbara** (Station Q): *Cactus knots and finite type knot invariants*
- 2006 Oct. **U.C. Davis** (Representation theory seminar): *Braidings for quantum groups at roots of 1.*
- 2005 Oct. **University of Oregon** (U.C. Lie theory): *Cartan subalgebras of root-reductive Lie algebras*
- 2004 Jun. **U.C. Davis:** *The abc conjecture for polynomials*

### Conference Organization:

- Lead organizer of 2020 MSRI semester program on “Quantum symmetry” (with S. Morrison).
- Organizing 2018 MRC on “Quantum symmetries” (with David Penneys and Julia Plavnik)
- Organized 2017 MSRI summer graduate school on “Subfactors” (with Scott Morrison and Emily Peters)
- Organized 2014 “Subfactor theory in mathematics and physics” conference (with Dietmar Bisch, Arnaud Brothier, Vaughan Jones, Scott Morrison, David Penneys, James Tener, and Rufus Willet)
- Organized 2014 Banff 5-day workshop on “Subfactors and fusion categories” (with Vaughan Jones, Scott Morrison, David Penneys, and Emily Peters)
- Organized 2012 AIM workshop on “Classifying Fusion Categories” (with Scott Morrison and Eric Rowell)
- Organized the three day 2007 RTG workshop (with Nicolai Reshetikhin)

### University Service:

- |           |  |
|-----------|--|
| 2021–2022 | DGMM search committee                  |
| 2020–2022 | Personnel committee                    |
| 2021      | Directed Reading Program               |
| 2020–2021 | Chair of math club committee           |
| 2020–2021 | University Sabbatical Review Committee |
| 2019      | IT committee                           |
| 2018–2019 | Personnel committee                    |
| 2018–2019 | Chair of Colloquium committee          |
| 2017–2018 | Graduate Advisory committee            |
| 2015 fall | Algebra Tier 1 committee               |

- 2013-2014 Math club committee  
2013 fall Algebra Tier 1 committee

**Teaching Activities:**

- 2021 fall –2022 spring Taught “Introduction to Lie Algebras and Lie Groups” (Indiana University Math M507)  
— Lectured, wrote exams, and wrote problems sets for the second year graduate class in Lie theory.
- 2021 fall Taught “Honors Calculus II” (Indiana University Math S212)  
— Lectured and wrote and supervised IBL worksheets for one 11 person class.
- 2021 spring Taught “Honors Calculus II” (Indiana University Math S212)  
— Lectured and wrote and supervised IBL worksheets for one 6 person class.
- 2020 fall Taught “Honors Calculus I” (Indiana University Math S211)  
— Lectured and wrote and supervised IBL worksheets for one 20 person class.
- 2020 fall Taught “Algebraic Number Theory” (Indiana University Math M601)  
— Lectured and supervised video projects for an advanced graduate class.
- 2019 fall Taught “Putnam exam seminar” (Indiana University Math M491)  
— Coached the Putnam team and ran a weekly problem solving seminar.
- 2019 spring Taught “Honors Calculus II” (Indiana University Math S212)  
— Lectured and wrote and supervised IBL worksheets for one 20 person class.
- 2018 fall Taught “Honors Calculus I” (Indiana University Math S211)  
— Lectured and wrote and supervised IBL worksheets for one 30 person class.
- 2018 fall Taught “Survey of Algebra” (Indiana University Math M501)  
— Lectured, wrote exams, and wrote problems sets for the first year graduate class in algebra.
- 2018 fall Taught “Putnam exam seminar” (Indiana University Math M491)  
— Coached the Putnam team and ran a weekly problem solving seminar.
- 2018 fall Taught “Colloquium” (Indiana University Math M599)  
— Ran the colloquium committee and supervised logistics of graduate student attendance.
- 2017 fall Taught “Survey of Algebra” (Indiana University Math M501)  
— Lectured, wrote exams, and wrote problems sets for the first year graduate class in algebra.
- 2017 fall Taught “Putnam exam seminar” (Indiana University Math M491)  
— Coached the Putnam team and ran a weekly problem solving seminar.
- 2016 fall Taught and course coordinated “Calculus I” (Indiana University Math M211)  
— Lectured for one 50 person class. Coordinated the course and departmental final for 12 sections.
- 2016 fall Taught “Representation Theory” (Indiana University Math M607)  
— Lectured, wrote exams, and wrote problems sets for the second year graduate class in Lie theory.
- 2015 fall –2016 spring Taught “Introduction to Lie Algebras and Lie Groups” (Indiana University Math M507)

- Lectured, wrote exams, and wrote problems sets for the second year graduate class in Lie theory.
- 2015 spring Taught “Honors Course in Modern Algebra II” (Indiana University Math S404)
  - Lectured, wrote exams, and wrote problems sets for the honors algebra class.
- 2014 fall Taught “Calculus I” (Indiana University Math M211)
  - Lectured for two 50 person classes.
- 2014 spring Taught “Introduction to Mathematical Reasoning” (Indiana University Math M391)
  - Lectured, wrote exams, and wrote problems sets for one 30 person class.
- 2013 fall Taught “Survey of Algebra” (Indiana University Math M501)
  - Lectured, wrote exams, and wrote problems sets for the first year graduate class in algebra.
- 2013 spring Taught “Introduction to Mathematical Reasoning” (Indiana University Math M391)
  - Lectured, wrote exams, and wrote problems sets for one 40 person class.
- 2012 fall Taught “Calculus 1” (Columbia University Math 1101)
  - Lectured, wrote exams, and wrote problems sets for two 100 person classes.
- 2011 spring Taught “Calculus 1” (Columbia University Math 1101)
  - Lectured, wrote exams, and wrote problems sets for an 80 person class.
- 2010 fall Taught “Group Representation Theory” (Columbia University Math 4044)
  - Lectured, wrote exams, and wrote problems sets.
- 2008–2009 Canada/USA Mathcamp academic coordinator
  - Organized and oversaw all academics, including hiring and training of new mentors, recruiting and interacting with visiting professors, and creating a 5-week class schedule with over a dozen teachers and 20 classes per day.
- 2006–2008 Canada/USA Mathcamp mentor
  - Designed and taught classes for advanced high-school students on topics ranging from unique factorization to continued fractions to planar algebras
- 2004–2005 Teaching assistant for at U.C. Berkeley (Calculus 1 and 2)
  - Taught discussion sections. Each class had three hours of section per week.
- 2003–2009 Spoke in 8 different Berkeley graduate seminars totalling over 30 talks.
- 2002 Summer Sophomore tutorial instructor at Harvard
  - $L$ -functions and  $\zeta$ -functions
- 2000 – 2001 Teaching assistant at Harvard
- 1998 – 2002 Ross Summer Math Program in number theory at the Ohio State University
  - Taught a biweekly seminar on number theory
  - Revised the daily problem sets
  - Lived in the dorm for 8 weeks each summer with advanced high-school students, helping with math questions

### Advising and mentoring:

Undergraduate REU students advised:

- Emi Brawley (2018)



- Jacob Prinz (2018)

Graduate students advised:

- Ryan Vitale (Ph.D. 2019)
- Josh Edge (Ph.D. 2019)
- Jordyn Harriger (Ph.D. 2021)
- Patrick Chu (Ph.D. 2022)
- Nachiket Karnick

Postdocs mentored:

- Nerses Aramian (2017-2018)
- Colleen Delaney NSF MSPRF (2019-2022)