Swarnava Mukhopadhyay

Associate Professor, School of Mathematics
Tata Institute of Fundamental Research.

Tata Institute of Fundamental Research,
School of Mathematics
1 Homi Bhabha Road
Colaba Mumbai-400005, India.

Phone: +91-22-22782654
E-mail: swarnava@math.tifr.res.in
Webpage: https://mathweb.tifr.res.in/~swarnava

Education

Ph. D. in Mathematics. August 2008 - May 2013.
University of North Carolina at Chapel Hill.
Advisor: Professor Prakash Belkale.

Master of Science in Mathematics. August 2008 - May 2010.
University of North Carolina at Chapel Hill.
Advisor: Professor Shrawan Kumar.

Bachelor Degree in Mathematics and Computer Science. August 2005 - May 2008.
Chennai Mathematical Institute, Chennai, India.

Positions Held

Associate Professor January 2024-.
School of Mathematics
Tata Institute of Fundamental Research-India.

Reader August 2018- December 2023.
School of Mathematics
Tata Institute of Fundamental Research-India.

Postdoctoral Fellow in Mathematics. September 2017-July 2018.
Max Planck Institute for Mathematics, Bonn - Germany.

Postdoctoral Fellow in Mathematics. August 2013 - August 2017.
University of Maryland - USA.
Mentor: Professor Patrick Brosnan.

Research Interests

- Algebraic Geometry and Representation Theory.

Preprints and Publications (since August 2018)

1. Graph potential and topological quantum field theories.
with P. Belmans and S. Galkin, arXiv:22205.07244, 48 pages, to appears in Proceedings of the London Mathematical Society.
2. Applications of the Liouville symplectic form on the cotangent bundle of the loop group,
with I. Biswas, Michi-Aki Inaba, Arata Komyo, Masa-Hiko Saito, 23 pages, in Advacned Studies in Pure Mathematics: volume of the 13th MSJ-SI proceedings "Differential Geometry and Integrable Systems"
3. Torelli theorem for the moduli stack of vector bundles and principal G-bundles,
with D. Alfaya, I. Biswas and Tomas Gomez, in Journal of Geometry and Physics, 207 (2025), Paper No. 105350, 15 Pages.
4. Motivic factorisation of KZ local systems and deformations of representation and fusion rings,
with P. Belkale and N. Fakhruddin, arXiv:2309.16993.

5. Torsors on moduli spaces of principal G-bundles on curves.
   with I. Biswas, to appear in International Journal of Mathematics, 35(2024), no.11, Paper No. 2450039, 20 Pages.
6. A parabolic analog of a theorem of Beilinson-Schechtman.
   with I. Biswas and R. Wentworth, in International Mathematics Research Notices IMRN(2024), no. 13, 10319–10348.
7. Graph potentials and symplectic geometry of the moduli spaces of vector bundles.
   with P. Belmans and S. Galkin, arXiv:22206.11584, 44 Pages.
8. Geometrization of the Hitchin/WZW/KZ connection
   with I. Biswas and R. Wentworth, arXiv:2110.00430, 29 Pages, in Letters in Mathematical Physics 114 (2024), no. 3, Paper No. 85, 39 pp.
9. A Hitchin connection on non-abelian theta functions for parabolic G-bundles.
   with I. Biswas and R. Wentworth, arXiv:2103.03792, in Crelle's Journal, J. Reine Angew. Math. 803 (2023), 137–181. 44 pages.
10. Crossed Modular categories and the Verlinde formula for twisted conformal blocks.
    with T. Deshpande, in Cambridge Journal of Mathematics, Volume 11, Number 1 (2023), 159–297.
11. Decompositions of the moduli space of vector bundles and graph potentials.
    with P. Belmans and S. Galkin, in Forum of Mathematics, Sigma. vol 11, 2023, 28 Pages.
12. Examples violating Golyshev's canonical strip hypothesis.
    with P. Belmans and S. Galkin, in Experimental Mathematics, Volume 31 Issue 1, 233–237 (2022).
13. Fundamental groups of moduli spaces of Principal bundles over a curve.
    with I. Biswas and A. Paul, in Geometriae. Dedicata 214 (2021), 629–650.
14. Appendix D: Rank-level duality a brief survey.
    "Conformal blocks, generalized theta functions and the Verlinde formula", New Mathematical Monograph series, Cambridge University Press, November 2021.
15. Spectral data for spin Higgs bundles.
    with R. Wentworth, in International Mathematics Research Notices. 2021, no. 6, 4211–4230.
16. Conformal embedding and twisted theta functions at level one.
    with H. Zelaci, MPIM preprints, in Proceedings of the American Mathematical Society, Vol 148, No 1, January 2020, 9-22.
17. Admissible subcategories in derived categories of moduli of vector bundles on curves.
    with P. Belmans, in Advances in Mathematics 351 (2019), 653–675.
18. Topology of hyperplane arrangements and tensor product of invariants.
    with P. Belkale and P. Brosnan, Michigan Mathematical Journal 68 (2019).
19. Generalized theta functions, strange duality, and odd orthogonal bundles on curves.
    with R. Wentworth, Communications in Mathematical Physics. 370 (2019), no. 1, 325- 376.

Preprints and Publications (before August 2018)

1. On Higher Chern classes of vector bundles of conformal blocks.
   with A. Gibney, arXiv:1609:04887.
2. Strange duality between G_2 and F_4 Verlinde spaces at level one.
   in Mathematische Zeitschrift, 283 (2016), no. 1-2, 387-399.
3. Non vanishing of conformal blocks divisor on $\overline{M}_{0,n}$.
   with P. Belkale and A. Gibney, in Transform. Groups 21 (2016), no. 2, 329-353.
4. Rank-level duality of conformal blocks for odd orthogonal Lie algebras in genus 0.
   in Transactions of the American Mathematical Society, 368 (2016), no. 9, 6741-6778.

5. Rank-level duality and conformal block divisors.
   in Advances in Mathematics 287 (2016), 389-411.
6. Vanishing and Identities of Conformal Blocks divisors on $\overline{\mathrm{M}}_{0,n}$.
   with P. Belkale and A. Gibney, in Algebraic Geometry (Foundation Composition Mathematica), 2 (2015), no. 1, 62-90.
7. Conformal blocks and cohomology in genus 0.
   with P. Belkale, Annales de l'Insitut Fourier (Grenoble) 64 (2014), no. 4, 1669-1719.
8. Remarks on level one conformal blocks divisors.
   Comptes Rendus Mathematique, de l'Académie de Sciences, Paris 352 (2014), no. 3. 179-182.
9. Diagram automorphisms and rank-level duality.
   arXiv:1308:1756. Part of this has appeared in my thesis Transactions of the American Mathematical Society, 368 (2016), no. 9, 6741-6778 and also in Shrawan Kumar's book.

Thesis and Unpublished Notes

1. Rank-level duality of conformal blocks, Phd Thesis (Advisor: Prakash Belkale).
2. Decomposition of Conformal Blocks, Masters Project Paper (Advisor: Shrawan Kumar).
3. Rank-level duality of conformal blocks for SL_n in genus 0 revisited.
4. Notes on action of diagram automorphism on conformal blocks divisors.

Research Talks

- Geometry and Stablity, ICTS, February 2025.
- Discussion meeting in Complex and Algebraic Geometry, Shiv Nadar University, December 2025.
- Geometry, Combinatorics and Representation theory, ICTS, November 2025.
- Mathematical Physics Seminar, Universtiy of California at Davis, 2025.
- Conference on "Geometry and representation theory associated to G torsors on curves", Brin Mathematics Center, University of Maryland, April 2025.
- Algebraic Geometry Seminar, University of Maryland, April 2025.
- Geometry and Topology seminar, University of Illinois at Chicago, April 2025.
- Colloquium, Fordham University, April 2025.
- Seminar on Geometry and Physics, Boston University, March 2025
- Discussion meeting on Bundles, KSOM Kozhikode, March 2025.
- Conference on Algebraic Combinatorial methods in Representation theory, ICTS, November 2023.
- Colloquium, IISER Pune, October 2023.
- Mini workshop in Algebraic Geometry, Max-Planck Institute, Bonn, June 2023.
- Learning Seminar on Stacks, University of Duisburg-Essen, June 2023.
- Differential Geometry Seminar, University of Heidelberg, June 2023.
- Seminar on Arithmetic and Algebraic Geomety, Mathematics Department Orsay, June 2023.
- Bundles Conference, TIFR Mumbai, March 2023.
- Seminar at Chennai Mathematical Institute, December 2022.
- Nottingham Algebraic Geometry Seminar, August 2022 (virtual).
- GANIT seminar, IIT-Gandhinagar, February 2022 (virtual).
- Geometry Seminar at Virginia Commonwealth University, February 2022 (virtual).
- Zoom Algebraic Geometry Seminar, June 2021 (virtual).

- Algebraic Geometry Seminar, University of Augsburg, February 2020 (virtual).
- Online seminar series, Chennai Mathematical Institute, July 2020 (virtual).
- EDGE seminar, University of Edinburgh, June 2020 (virtual).
- Oberseminar Representation Theory, University of Bonn, May, 2020 (virtual).
- Mini-Workshop on Bundles, Cycles and Motives, Harish Chandra Research Institute, March 2020.
- Geometry and Topology Seminar, Indian Institute of Science, Bangalore, November 2019.
- Quantum Space Time Seminar, Department of Theoretical Physics, TIFR, Mumbai, October 2019.
- Conference on Analytic and Algebraic Geometry, Kerela School of Mathematics, Kerala, March 2019.
- Colloquium, Annual Talks, Tata Institute of Fundamental Research, February 2019.
- EDGE seminar, University of Edinburgh, April 2018.
- Seminar on algebra, topology and geometry, University of Nice Sophia Antipolis, February 2018.
- Oberseminar, University of Duisberg-Essen, November 2017.
- Workshop on algebraic varieties, Hodge theory and Motives, Fields Institute, March 2017.
- Geometry, Physics and Representation Theory Seminar, Northeastern University, February 2017.
- Colloquium, University at Buffalo, New York, November 2016.
- Algebra and Number Theory Seminar, University of Maryland, October 2016.
- Workshop on New Perspectives on Moduli Spaces in Gauge Theory, NUS Singapore, August 2016.
- Colloquium, Tata Institute of Fundamental Research, Mumbai, July 2016.
- Algebra Seminar, Indian Statistical Institute, Bangalore, July 2016
- Departmental Seminar, Indian Institute of Science, Bangalore, July 2016.
- Algebraic Geometry Seminar, Chennai Mathematical Institute, Chennai, July 2016.
- Algebra Seminar, Institute of Mathematical Science, Chennai, July 2016.
- Geometry Seminar, Texas A&M University, TX, April 2016.
- AMS Eastern Section Meeting, University of Georgia, GA, March 2016.
- TADS Seminar, George Mason University, VA, Feb 2016.
- Colloquium, Virginia Polytechnical Institute and State University, VA, Nov 2015.
- Algebraic Geometry Seminar, Caltech, CA, Oct 2015.
- Talk in contributed session, Summer Research Institute in Algebraic Geometry, UT, July 2015.
- Research Seminar, Park City Math Institute, UT, July 2015.
- Lie groups and Representation Theory Seminar, University of Maryland, April 2015.
- Algebraic Geometry Seminar, University of Georgia, GA, March 2015.
- Conference at Chennai Mathematical Institute, Chennai, India, January 2015.
- Indian Institute of Science Education and Research, Pune, India, January 2015.
- Lie groups and Representation Theory Seminar, University of Maryland, November 2014.
- AMS Sectional Meeting, Greensboro, NC, November 2014.
- ICM satellite conference on Topology and Physics of Moduli space of Higgs Bundles, NUS Singapore, August 2014.

- Algebraic Geometry Seminar, Tata Institute of Fundamental Research, Mumbai, India, August 2014.
- Algebraic Geometry Seminar, Chennai Mathematical Institute, Chennai India, August 2014.
- Geometric Representation Theory Seminar, UNC-Chapel Hill, NC, April 2014.
- Algebra Seminar, Virginia Polytechnical Institute and State University, VI, April 2014.
- Lie groups and Representation Theory Seminar, University of Maryland, March 2014.
- Lie groups and Representation Theory Seminar, University of Maryland, September 2013.
- Algebraic Geometry Seminar, Athens, GA, March 2013.
- Geometric Representation Theory Seminar, UNC-Chapel Hill, NC, April 2013.
- Contributed Paper Session, Joint Mathematics Meeting, San-Diego, January 2013.
- Southeast Lie theory conference, Charlestown, SC, December 2012.
- Algebra and Number Theory Seminar, University of Maryland, MD, September 2012.

Seminar and Workshop organization

1. Discussion meeting in algebraic geometry and representation theory, February 19-23, 2026.
2. Panorama Lectures by Pavel Etingof, joint with Tanmay Deshpande, February 19-23, 2026.
3. Geometric and category-theoretic approaches to conformal field theory, joint with Angela Gibney, Sashank Kanade, Florecia Orosz, & Harshit Yadav, BIRS Program at Chennai Mathematical Institute, January 5-9, 2026.
4. Geometry and Representation theory associated to G-torsors on curves, jointly with Johan Martens and Richard Wentworth, Brin Mathematics Center, April 21-25, 2025.
5. Discussion meeting in Algebraic Geometry, jointly with T. Deshpande and C. Ravi, February 10-14, 2025.
6. Annual talks, School of Mathematics, TIFR, February 3-4, 2025.
7. Discussion meeting on Bundles, jointly with A. J. Parameswaran, March 25-28, 2024.
8. Annual talks, School of Mathematics, TIFR, February 21-23, 2024.
9. Preprint seminar in Algebraic Geometry, jointly with Anand Sawant, Fall 2022, Spring 2023, Fall 2023 & Spring 2024.
10. Colloquium in the School of Mathematics, January 2024-.
11. Algebraic Geometry Session, Ramanujan Mathematical Society Symposium, Chennai December 2022.
12. Bundles and conformal blocks with a twist, ICMS workshop, Edinburgh, jointly with Chiara Damiolini and Johan Martens, June 2022.
    (Funded by ICMS-Edinburgh, Engineering and Physical Sciences Research Council, Edinburgh Mathematical Society, Foundation Compositio Mathematica, Glasgow Mathematical Journal & National Science Foundation, U.S.A.)
13. Algebraic Geometry Seminar, Tata Institute of Fundamental Research (online), jointly with Anand Sawant, Fall 2020, Spring 2021 & Fall 2021.
14. Derived Categories and geometry of algebraic varieties, Tata Institute of Fundamental Research, jointly with Tanmay Deshpande, February 2020.

Honors and Awards

- Humboldt Fellowship for experienced researchers, May-July, 2027-2029.
- MATRICS research award, Anusandhan National Research Foundation, 2025.
- Visitor, Brin Mathematical Center, University of Maryland, April, 2025.
- Visiting Scientist, Max Planck Institute for mathematics, Bonn, May-June, 2023.

- Young Scientist Medal, Indian National Sciences Academy, 2022.
- Startup Research Grant, Science and Engineering Research Board(SERB), Govt. of India, December 2019-December 2021.
- Visiting Scientist, Max Planck Institute for mathematics, Bonn, April-May, 2019.
- Travel Support from GEAR-network, University of Maryland, June 2016.
- Research Program Member, Park City Mathematics Institute, July 2015.
- AMS-Simons travel award, 2015.
- Travel Support from GEAR-network, University of Maryland, March 2015.
- Research Assistantship funded by NSF FRG grant DMS-1361159 under PI: P. Brosnan, 2014-2016.
- Lottie Wilson Fund Scholarship, University of North Carolina, 2012-2013.
- Future Faculty Fellowship Award, University of North Carolina, May 2012.
- Research Assistantship funded by NSF grant DMS-0901249 under PI: P. Belkale, 2010-2012.

Comittee Work

- Co-organizer, Vigyan Vidushi Program, School of Mathematics, TIFR, 2023.
- Member, Administering Commitee for Infosys Leading Edge Travel Grant, TIFR (2021-2022).
- Member, Program committee for National Center for Mathematics workshops, NCM (2022-).
- Member, Canteen committee, Tata Institute of Fundamental Research.
- Member, Administering Committee for the endowment received from Sarojini Damodaran Foundation, TIFR. (2021-).
- Member, Apex Committee of National Center for Mathematics IIT Bombay-TIFR (2021-),
- Publications Committee, School of Mathematics, TIFR (2019-).
- Faculty Search Committee, School of Mathematics, TIFR (2019-2025).
- Postdoctoral Search Committee, School of Mathematics, TIFR (2026-).
- Co-coordinator, Visiting Students Research Programme, School of Mathematics, TIFR, 2019.

Visitors Hosted

- Professor Pavel Etingof, MIT, USA.
- Professor Ved Datar, IISc.
- Professor Jochen Heinloth, University of Duisburg Essen, Germany.
- Dr. Mohan Swaminathan, Stanford University.
- Professor Prakash Belkale, University of North Carolina at Chapel Hill, U.S.A.
- Dr Abhishek Oswal, Caltech, U.S.A.
- Professor Shinnosuke Okawa, Osaka University, Japan.
- Dr Pieter Belmans, University of Bonn and University of Antwerp.
- Professor Sergey Galkin, PUC-Rio, Brazil.
- Professor Richard Wentworth, University of Maryland.
- Professor Johan Martens, University of Edinburgh.
- Professor Szilard Szabo, Budapest University.

Service

- Referee/Quick opinions for various peer reviewed math journals: Journal of the American Mathematical Society, Advances in Mathematics, Crelle's Journal, Inventiones, Communication in Mathematical Physics, International Mathematics Research Notices, Geometriae Dedicata, Epijournal de Geometrie Algebrique, Annales Henri Poincare, Mathematics Research Letters, Selecta Mathematica, Moduli.
- Advising math majors on course work, University of Maryland, College Park, MD, 2013-2017.
- Volunteer at Family Science Day, Morehead Planetarium, Chapel Hill, NC, 2011.
- Volunteer at Family Science Day, Morehead Planetarium, Chapel Hill, NC, 2010.
- Volunteer at Sonia Kovalevsky Day, Department of Mathematics, Chapel Hill, NC, 2010.

Masters Project

- Masters project of Mr Arnab Roy, Spring 2022.

Ph.D. students

- Mr Sagar Srivastava, 2024 (joint with Professor C. S. Rajan)

Courses Taught

- Reading course on conformal blocks, moduli of bundles, Rajesh Manna, Spring 2026.
- Graduate Algebraic Geometry, Fall 2025.
- Reading course on moduli of bundles and conformal blocks, Dheeraj D, Spring 2025.
- Reading course on complex geometry, Swapnajit Das, Spring 2025.
- Reading group on Moduli problems and algebraic stacks, (joint with C. Ravi), TIFR Spring 2025.
- Reading course on abelian varieties, Dheeraj D, Fall 2024.
- Analysis II, Graduate Course for 1st year students, Tata Institute of Fundamental Research, Spring 2024.
- Reading course on derived categories following Kashiwara-Schapira, Russell D Cruz, Fall 2023.
- Algebra I, Graduate Course for 1st year students, Tata Institute of Fundamental Research. Fall 2022.
- Reading course in Algebraic Geometry with a focus on Abelian varieties with Mr Arnab Roy, Fall 2021.
- Reading course in Algebraic Geometry and Gromov Witten theory with Mr Arkamouli Debnath, Fall 2021.
- Reading course in Algebraic Geometry with Mr Manodeep Raha, Spring 2021.
- Advanced Topics Course in Representation Theory, Tata Institute of Fundamental Research, Spring 2021.
- Reading course in Algebraic Geometry with Mr Neeladri Patra and Mr Manodeep Raha, Fall 2020.
- Representation Theory of Lie algebras, Tata Institute of Fundamental Research, Fall 2020, Fall 2024.
- Learning Seminar on Perverse Sheaves and the decomposition theorem, (joint with T. Deshpande), Tata Institute of Fundamental Research, Spring 2019.
- Math 808, Geometric Invariant Theory, University of Maryland, Spring 2016.
- Math 808, Geometric Representation Theory, University of Maryland, Fall 2014.
- Math 411, Advanced Calculus II, University of Maryland, Spring 2014.
- Stat 410, Introduction to Probability Theory, University of Maryland, Spring 2017.

- Math 410, Advanced Calculus I, University of Maryland, Fall 2013, Fall 2015 and Fall 2016.
- Math 241, Calculus III, University of Maryland, Spring 2015.
- Math 141, Calculus II, University of Maryland, Fall 2016.
- Math 547, Linear Algebra and Applications-Summer Session II 2013.
- Math 232, Calculus II, UNC-Chapel Hill, Spring 2012, Fall 2011, Spring 2010.
- Math 130, Precalculus, UNC-Chapel Hill, Summer 2012, Summer 2010, Fall 2009.
- Math 118, Topics in Mathematics, UNC-Chapel Hill, Summer 2011, Spring 2011, Fall 2011.

Visiting Students Research Program, TIFR

- Mr. Om Sai, Summer 2025.
- Ms. Sudipa Das, Summer 2020.
- Mr Kartik Sharma and Mr Arka Karmakar, Summer 2021.
- Ms Dinny Daniel, Summer 2022.
- Mr Sankalp Sundar, Summer 2023.

Expository Lectures

- Four lectures on the topic "Enumerative Geometry and Recursion"for students selected for the Visiting Students Research Programme of the School of Mathematics in Summer 2019.
- Colloquium in Visiting Students Research Programme of the School of Mathematics in Summer 2021.

Professional Development

- Future Faculty Fellowship Program, Center for Faculty Excellence, UNC-Chapel Hill, May 2012.
- TA Training Seminar, Department of Mathematics, UNC-Chapel Hill, Fall 2008.

Relevant Skills

- Languages: English, Hindi, Bengali.
- Computer Skills: Sage, Macaulay2, GAP.

References

Professor Prakash Belkale
University of North Carolina at Chapel Hill
Department of Mathematics
Chapel Hill, NC
belkale@email.unc.edu

Professor Patrick Brosnan
University of Maryland
Department of Mathematics
College Park, MD
pbrosnan@math.umd.edu

Professor Richard Wentworth
University of Maryland
Department of Mathematics
College Park, MD
raw@math.umd.edu