

SACHIN GAUTAM
CURRICULUM VITAE

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Research Interests

Cluster algebras, Classical and Quantum integrable systems, Representation Theory, Braid groups, Quantum Groups.

Education

- Ph.D. in Mathematics, *Northeastern University*, Boston, USA (2005-2011).
Ph.D. Thesis under the supervision of Prof. V. Toledano Laredo and Prof. A. Zelevinsky.
- M.Sc. in Mathematics, *Institute of Mathematical Sciences* Chennai, India (2003-2005).
M.Sc. Thesis under the supervision of Prof. K.N. Raghavan
- B.Tech. in Computer Science and Engineering, *Indian Institute of Technology*, New Delhi, India (1999-2003).
B.Tech. Thesis under the supervision of Prof. A. Tripathi

Positions

- Assistant Professor at OSU (current).
- Postdoctoral Fellow at Perimeter Institute for Theoretical Physics (2015-2017).
- J.F. Ritt Assistant Professor at Columbia University (2011-2015).
- Visiting researcher at IHP, Paris, France (Summer 2014).
- Visiting researcher at IHES, Bures-sur-Yvette, France (Summer 2013).
- Visiting researcher at FIM, ETH Zürich, Switzerland (June 2012).

Awards

- R-matrices and affine Yangians, Research in Pairs program at CIRM, Trento, Italy (joint with Andrea Appel and Curtis Wendlandt). Period: May 21 - June 10, 2023.
- R-matrices and Weyl group symmetries, Research in Pairs program at MFO, Oberwolfach, Germany (joint with Andrea Appel and Curtis Wendlandt). Period: October 23-30, 2021.

- Collaboration Grant for Mathematicians, Simons Foundation. Starting September 2017. Award Number 526947. Duration 5 years.
- Dissertation Writing Fellowship, Graduate school of arts and sciences, Northeastern University (Fall 2010).
- Ling-Ma Fellowship, Department of Mathematics, Northeastern University (Summer 2010).
- Research Assistantship at Northeastern University, Boston, USA (2008-2010) funded by **Flat connections, Irregular Singularities and Quantum Groups**. NSF grant DMS-0707212. Principal investigator: Valerio Toledano Laredo. Full time support from: June 1, 2008–May 31, 2010.
- Teaching Assistantship at Northeastern University, Boston, USA (2005-2008)
- Junior Research Fellowship sponsored by Department of Atomic Energy at Institute of Mathematical Sciences, Chennai, India (2003-2005)

Publications

I. Published in refereed journals

- (1) *On multicolor non-complete Ramsey graphs of star graphs* (with A. Srivastava and A. Tripathi), *Discrete Applied Mathematics*, **156** (2008), no. 12, 2423 - 2428.
- (2) *Cluster Algebras and Grassmannians of type G_2* , *Algebras and Representation Theory* **13** (2010), no. 3, 335 - 357.
- (3) *Yangians and quantum loop algebras* (with V. Toledano Laredo), *Selecta M.* **19** (2013), no. 2, 271-336.
- (4) *Monodromy of the trigonometric Casimir connection of \mathfrak{sl}_2* (with V. Toledano Laredo), *Noncommutative Birational Geometry, Representations and Combinatorics* (A. Berenstein and V. Retakh eds.), *Contemporary Mathematics* **592**, AMS (2013), 137–176.
- (5) *Yangians, quantum loop algebras and abelian difference equations* (with V. Toledano Laredo), *J. Amer. Math. Soc.* **29** (2016), no. 3, 775-824.
- (6) *Meromorphic tensor equivalence for Yangians and quantum loop algebras* (with V. Toledano Laredo), *Publ. Math. IHES.* **125** (2017), 267-337.
- (7) *An explicit isomorphism between quantum and classical $sl(n)$* (with A. Appel), *Transformation groups* **25** (2020), no. 4, 945-980.
- (8) *The meromorphic R-matrix of the Yangian* (with V. Toledano Laredo and C. Wendlandt), in Alekseev, A., Frenkel, E., Rosso, M., Webster, B., Yakimov, M. (eds) *Representation Theory, Mathematical Physics, and Integrable Systems*. Progress in

Mathematics, vol 340, Birkhäuser, Cham, 2021 (69 pages).

- (9) *Three facets of R-matrices* (with A. Smirnov, C. Wendlandt and M. Yamazaki) MFO workshop reports (DOI: 10.14760/OWR-2021-51) (25 pages).
- (10) *Poles of finite-dimensional representations of Yangians* (with C. Wendlandt), *Selecta M.* **29** (2023), no. 1, article 13 (68 pages).
- (11) *On a conjecture of Khoroshkin and Tolstoy* (with A. Appel and C. Wendlandt), *IMRN* (2022) (<https://doi.org/10.1093/imrn/rnac334>) (17 pages) .

II. Preprints

- (1) *Elliptic quantum groups and their representations* (with V. Toledano Laredo), arxiv:1707.06469 (52 pages).
- (2) *The R-matrix formalism of quantized enveloping algebras* (with M. Rupert and C. Wendlandt), arxiv:2210.06770 (45 pages).

III. In preparation

- (1) *Lattice operators for quantum affine algebras* (with V. Toledano Laredo), 2023.
- (2) *The R-matrix of the affine Yangian* (with A. Appel and C. Wendlandt), 2023.

Organization

- *Three facets of R-matrices* Mini-workshop at MFO Oberwolfach joint with A. Smirnov, C. Wendlandt and M. Yamazaki (October 17-23, 2021).
- *Representation Theory seminar* (Current), The Ohio State University, Columbus, OH.
- *Workshop on Yangians and quantum loop algebras* (May 2014), University of Texas, Austin (USA).
- *Seminar on dynamical Yang-Baxter equations* (Spring 2011), Northeastern University, Boston (USA).
- *Graduate students' seminar* (Fall 2006, Spring 2007), Northeastern University, Boston (USA).

Mentoring.

- C. Wendlandt (Zassenhaus Assistant Professor at OSU) 2019–2021.

Ph.D. students

- Doyun Koo (current).

Dissertation committees served.

- Quan Chen, *Higher symmetries in operator algebras*, April, 2023.

- Matthew Harper, *Classical and quantum knot invariants*, June 2021.
- Roberto Hernandez Palomares, *Quantum symmetries for quantum spaces*, April 2021.
- Michael Belfanti, *Aspects of automorphic induction*, May 2018.

Conference Talks

- (1) *Three facets of R-matrices* (October 2021), Oberwolfach, Germany.
- (2) *AMS special session on elliptic cohomology and elliptic quantum groups* (January 2020), Denver, CO, USA.
- (3) *Higher symmetries* (March 2019), Aspen center for physics, Aspen, CO, USA.
- (4) *AMS special session on recent advancements in representation theory* (September 2017), State University of New York at Buffalo, NY, USA.
- (5) *KTGU mathematics workshop for young researchers* (February 2017), Kyoto, Japan.
- (6) *Joint India-AMS meeting* (December 2016), Banaras Hindu University, Varanasi, India.
- (7) *Geometric representation theory* (January 2016), Simons Center for Geometry and Physics, Stony Brook, USA.
- (8) *Algebraic Lie theory and representation theory* (September 2014), ICMS, Edinburgh, UK.
- (9) *ARTIN 41* (June 2014), University of Edinburgh, UK.
- (10) *Workshop on combinatorial representation theory* (April 2014), CRM Montreal, Canada.
- (11) *AMS special session on geometric and combinatorial methods in representation theory* (November 2013), University of California Riverside, Riverside, CA, USA.
- (12) *Journées Solstice d'été 2012, Topologie, Groupes et Algèbre* (June 2012) Paris, France.
- (13) *Representation theory and integrable systems* (June 2012) ETH Zürich, Switzerland.
- (14) *Geometry of derived categories and representation theory* (May 2012) Northeastern University, Boston, MA, USA.
- (15) *Joint Mathematics Meeting, AMS special session on noncommutative birational geometry and cluster algebras* (January 2012) Boston, MA, USA.

- (16) *AMS special session on quantum groups and representation theory* (October 2011) University of Nebraska–Lincoln, NE, USA.
- (17) *Equivariant quantum differential equations* (September 2011) Columbia University, New York, NY, USA.
- (18) *Twenty–five years of representation theory of quantum groups* (August 2011), Banff International Research Station, Alberta, Canada.
- (19) ETH (January 2011), Zürich, Switzerland.
- (20) *Graduate students’ seminar* during the conference on *Geometric methods in representation theory* (July 2008), Institut Fourier, Grenoble, France.

Seminar Talks and Lectures.

- (1) *Summer school on Lie algebras* (July 2022), Univeristà degli studi di Perugia, Italy.
- (2) *Reading classics seminar* (December 2021), The Ohio State University, Columbus, OH, USA.
- (3) *Mathematical Physics seminar* (December 2021), Purdue University, West Lafayette, IN, USA.
- (4) *Séminaire d’algèbre* (May, 2021), Insitut Henri Poincaré Paris, France.
- (5) *Italian representation theory seminar* (May, 2021), Online Seminar.
- (6) *Representations and Number Theory seminar* (April, 2021), Chinese University of Hong Kong (online).
- (7) *Algebra and discrete mathematics seminar* (February, 2021), University of California, Davis (online).
- (8) *Reading classics seminar* (December, 2020), The Ohio State University, Columbus, OH, USA.
- (9) *Reading classics seminar* (April 2019), The Ohio State University, Columbus, OH, USA.
- (10) *Radical Pi Undergraduate seminar* (April 2019), The Ohio State University, Columbus, OH, USA.
- (11) *Representation theory seminar* (February 2019), U. Mass. Amherst, MA, USA.
- (12) *Geometric representation theory seminar* (February 2019), MIT, Cambridge, MA, USA.

- (13) *Geometry seminar* (October 2018), Boston University, Boston, MA, USA.
- (14) *Representation theory seminar* (August, September 2018), The Ohio State University, Columbus, OH, USA.
- (15) *Algebra seminar* (March 2018), University of Alberta, Edmonton, Canada.
- (16) *Representation theory seminar* (January 2018), The Ohio State University, Columbus, OH, USA.
- (17) *Reading classics seminar* (October 2017), The Ohio State University, Columbus, OH, USA.
- (18) *Welcome seminar* (March 2017), The Ohio State University, Columbus, OH, USA.
- (19) *Geometry, physics and representation theory* (March 2017), Northeastern University, Boston, USA.
- (20) *Physics Journal Club* (December 2016), Institute of Mathematical Sciences, Chennai, India.
- (21) *Geometry and topology seminar* (November 2016), University of Waterloo, Canada.
- (22) *Geometric representation theory seminar* (September 2015), Field institute, University of Toronto, Canada.
- (23) *Representation theory seminar* (October 2014), Yale University, New Haven, CT, USA.
- (24) *Séminaire d'algèbre* (June 2014), Institut Henri Poincaré, Paris, France.
- (25) *Geometric representation theory seminar* (March 2014), Field institute, University of Toronto, Canada.
- (26) *Algebra seminar* (March 2014), University of Alberta, Edmonton, Canada.
- (27) *Algebra seminar* (October 2013), UCLA, Los Angeles, CA, USA.
- (28) *Informal Mathematical Physics seminar* (October 2013), Columbia University, New York, NY, USA.
- (29) *Séminaire algèbre et géométrie* (June 2013), Université de Caen, Caen, France.
- (30) *Séminaire d'algèbre* (June 2013), Institut Henri Poincaré, Paris, France.
- (31) *Informal Mathematical Physics seminar* (May 2013), Columbia University, New York, NY, USA.

- (32) *Representation theory seminar* (April 2012) City University of New York, NY, USA.
- (33) *Research training group in representation theory, geometry and combinatorics* (September 2011) University of California Berkeley, CA, USA.
- (34) *Infinite dimensional algebras seminar* (November 2010), MIT, Cambridge, MA, USA.
- (35) *Geometry seminar* (October 2010), Boston University, Boston, MA, USA.
- (36) *Tapas seminar* (June 2006, 2008 and 2010), Northeastern University, Boston, MA, USA.

Colloquium Talks

- (1) *CIRM colloquium in algebra and geometry*, Univeristà degli studi di Trento (May 2023), Trento, Italy.
- (2) *Invitations to mathematics series*, The Ohio State University (October 2022), Columbus, Ohio, USA.
- (3) Cleveland State University (February 2020), Cleveland, OH, USA.
- (4) *Invitations to mathematics series*, The Ohio State University (October 2019), Columbus, Ohio, USA.
- (5) *Invitations to mathematics series*, The Ohio State University (October 2017), Columbus, Ohio, USA.
- (6) Intitute of Mathematical Sciences (December 2016), Chennai, India.
- (7) Intitute of Mathematical Sciences (December 2015), Chennai, India.
- (8) Colorado State University (February 2015), Fort Collins, Colorado, USA.
- (9) Ohio State University (January 2015), Columbus, Ohio, USA.
- (10) University of North Carolina Chapel Hill (January 2015), North Carolina, USA.
- (11) Perimeter Institute for Theoretical Physics (December 2014), Waterloo, Ontario, Canada.
- (12) University of Illinois (December 2014), Chicago, Illinois, USA.
- (13) University of Illinois at Urbana-Champaign (December 2014), Champaign, Illinois, USA.

(14) Institute of Mathematical Sciences (August 2012), Chennai, India.

Teaching

- (1) Linear algebra (Spring 2021, 2022).
- (2) Honors Complex Analysis (Spring 2022).
- (3) Complex analysis (Spring 2020).
- (4) Topics in representation theory (Fall 2019).
- (5) Reading course on symmetric functions (Spring 2019).
- (6) Honors Abstract Algebra (Fall 2018).
- (7) Abstract Algebra II (Spring 2018, 2021).
- (8) Abstract Algebra I (Fall 2017).
- (9) Lie Groups and representation theory (Spring 2017).
- (10) Complex analysis (Spring 2015).
- (11) Lie groups and representations II (Spring 2015).
- (12) Topics in Representation Theory (Spring 2014).
- (13) MATH V1102 Calculus II (Spring 2013).
- (14) MATH V1101 Calculus I (Spring 2012).
- (15) MATH V1201 Calculus III (Fall 2011, Fall 2012, Fall 2013, Fall 2014).
- (16) MTH U341 Calculus III for Science and Engineering (Spring 2008).
- (17) MTH U241 Calculus I for Science and Engineering (Fall 2007).
- (18) MTH U115 Applications of Algebra (Fall 2006 and Spring 2007).
- (19) Recitation Instructor for Calculus III (Fall 2005 and Spring 2006).
- (20) Part time instructor of Mathematics at Government Senior Secondary School, Shahdara, New Delhi (April 2000 - March 2002).

Conferences and Workshops

- (1) Quantum structures in algebra and geometry, Northeastern University and MIT, Boston, MA, USA (August 2019).

- (2) Higher symmetries in physics and mathematics, Aspen center for physics, Aspen, CO, USA (March 2019).
- (3) Enveloping algebras and representation theory, Oberwolfach, Germany (November 2018).
- (4) Higher algebras and QFT, Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada (August 2018).
- (5) KTGU mathematics workshop for young researchers, Kyoto University, Japan (February 2017).
- (6) Geometric representation theory program, Simons Center for Geometry and Physics, Stony Brook, USA (January 2016).
- (7) Mathematical aspects of six-dimensional quantum field theories, UC Berkeley, USA (December 2014).
- (8) Workshop on categorical methods in harmonic analysis and number theory, MSRI, Berkeley, USA (November 2014).
- (9) Algebraic Lie theory and representation theory, ICMS, Edinburgh, UK (September 2014).
- (10) ARTIN 41, University of Edinburgh, UK (June 2014).
- (11) Workshop on Yangians and quantum loop algebras, Austin, TX, USA (May 2014).
- (12) Combinatorial Lie theory, CRM, Montreal, Canada (April 2014).
- (13) Workshop on quiver varieties, Simons center of geometry and physics, Stony Brook, NY, USA (October 2013).
- (14) DT invariants in Paris, Paris 7, France (June 2013).
- (15) Algebra, Combinatorics and Representation Theory: in memory of Andrei Zelevinsky, Northeastern University, Boston, MA, USA (April 2013).
- (16) Interactions between non-commutative birational geometry and representation theory, MSRI Berkeley, CA, USA (April 2013).
- (17) Journées Solstice d'été 2012. Topologie, Groupes et Algèbre. CIRM Paris, France (June 2012).
- (18) Representation theory and integrable systems, ETH Zürich, Switzerland (June 2012).
- (19) Geometry of derived categories and representation theory, Northeastern University, Boston, MA, USA (May 2012).

- (20) Joint Mathematics Meeting, AMS special session on noncommutative birational geometry and cluster algebras, Boston, MA, USA (January 2012).
- (21) AMS special session on quantum groups and representation theory, University of Nebraska–Lincoln, NE, USA (October 2011).
- (22) Equivariant quantum differential equations, Columbia University, New York, NY, USA (September 2011).
- (23) Research training group in representation theory, geometry and combinatorics, University of California Berkeley, CA, USA (September 2011)
- (24) Twenty–five years of representation theory of quantum groups, Banff International Research Station, Alberta, Canada (August 2011)
- (25) Nonperturbative effects and dualities in QFT and integrable systems, University of California Santa Barbara, CA, USA (August 2011)
- (26) The versatility of integrability (conference in honor of 60th birthday of Igor Krichever), Columbia University, NY, USA (May 2011)
- (27) Derived categories of algebro-geometric origin and integrable systems, Institute of Advanced Studies, Hebrew University of Jerusalem, Israel (December 19-24, 2010)
- (28) Langlands type dualities in Quantum Field Theory, Kavli Institute of Theoretical Physics, University of California, Santa Barbara, CA, USA (August 9-27, 2010).
- (29) NSF/CBMS conference on Quiver varieties and crystal bases of quantum affine algebras, North Carolina State University, Raleigh, NC, USA (May 25-29, 2010).
- (30) Double affine Hecke algebras and Algebraic Geometry, MIT, Cambridge, MA, USA (May 17-21, 2010).
- (31) Geometric Representation Theory and extended affine Lie algebras, University of Ottawa, Ontario, Canada (June 15-27, 2009).
- (32) International conference on cluster algebras and related topics, UNAM, Mexico (December 8-20, 2008).
- (33) Gauge theory and Langlands duality, Kavli Institute for Theoretical Physics, University of California Santa Barbara, CA, USA (July 21 - August 8, 2008).
- (34) Geometric methods in Representation Theory, Summer school at Institut Fourier, Grenoble, France (June 16 - July 4, 2008).
- (35) Conference on Algebro-Geometric derived categories and applications, School of Mathematics, Institute of Advanced Study, Princeton, NJ, USA (March 10-14, 2008).

- (36) XII International Conference on Representations of Algebras, Torun, Poland (August 14-24, 2007).
- (37) NSF/CBMS conference on Cluster Algebras and Applications, North Carolina State University, Raleigh, NC, USA (June 13-17, 2006).
- (38) Geometry and Representation Theory (conference in honor of 60th birthday of G. Lusztig), MIT, Cambridge, MA, USA (May 30 - June 3, 2006).
- (39) Joint India-AMS Mathematical meeting, Indian Institute of Science, Bangalore, India (December, 2003).
- (40) Workshop on computational Algebraic Geometry, Harish-Chandra Research Institute, Allahabad, India (December 2002)