

Francesco Sala

Curriculum Vitae

Current Position

- 2019–Present **Assistant Professor (RTDb)**, *Università di Pisa*, Italy.
2019–Present **Visiting Associate Scientist**, *Kavli IPMU, University of Tokyo*, Japan.

Employments

- 2016–2019 **Postdoctoral Fellow**, *Kavli IPMU, University of Tokyo*, Japan.
2014–2016 **Postdoctoral Fellow**, *University of Western Ontario*, London, Canada.
2012–2014 **Postdoctoral Research Associate**, *Heriot-Watt University*, Edinburgh, UK.

Education

- 2011 **Ph.D. in Geometry and Doctorat en Mathématiques Pures (co-tutorial thesis)**, *SISSA, Trieste*, Italy and *Université Lille 1*, France.
Advisors: U. Bruzzo and D. Markushevich
2008 **Master's Degree in Mathematics (in collaboration with SISSA)**, *Università degli Studi di Trieste*, Italy, 110/110 cum laude.
2008 **Diploma "Percorso Formativo Comune"**, *SISSA, Trieste*, Italy.
2006 **Bachelor's Degree in Mathematics**, *Università degli Studi di Palermo*, Italy, 110/110 cum laude.

Academic Qualification

- 2020 – 2029 **"Abilitazione Scientifica Nazionale"**.
Qualified for the "Abilitazione Scientifica Nazionale a Professore di Seconda Fascia - Settore concorsuale 01/A2 Geometria e Algebra" to work as an Associate Professor in Geometry and Algebra at an Italian University

Grants and Fellowships

- 2021–2026 **Grant-in-Aid for Scientific Research C (PI, no. 21K03197) "Yangians and Cohomological Hall algebras of curves"**, *Japanese Society for the Promotion of Science (JSPS)*, Japan, ¥ 4,290,000.
2020–2022 **Progetto di Ricerca di Ateneo (no. PRA_2020_40) "Spazi di moduli, geometria aritmetica e aspetti storici"**, with A. Bandini, A. Cogliati, V. Melani, T. Szamuely, M. Talpo, *Università di Pisa*, Italy, € 31,625.
2018–2020 **Grant-in-Aid for Young Scientists (PI, no. JP18K13402) "Cohomological Hall algebra of a curve"**, *Japanese Society for the Promotion of Science (JSPS)*, Japan, ¥ 2,860,000.
2017–2019 **Grant-in-Aid for Research Activity Start-up (PI, no. JP17H06598) "Hall algebras and gauge theory on a surface"**, *Japanese Society for the Promotion of Science (JSPS)*, Japan, ¥ 1,300,000.
2015–2022 **Conference Grants, Foundation Compositio Mathematica.**
 - New Perspectives on Hyperkähler Manifolds. A Celebration of Dimitri Markushevich's 60 Birthday. 2022
 - IHÉS Summer School on Enumerative Geometry, Physics and Representation Theory. 2021
 - CIME School on Geometric Representation Theory and Gauge Theory. 2018
 - Workshop on Hall algebras, enumerative invariants and gauge theories. 2016
 - Workshop on Moduli spaces in Algebraic Geometry and Mathematical Physics. 2015

2012–2014 **Postdoctoral Research Associate Fellowship**, *The Leverhulme Trust*, UK.
2008–2011 **Ph.D. Student Fellowship**, *SISSA, Trieste*, Italy.
2006–2008 **Master's degree Student Fellowship "Percorso Formativo Comune"**, *SISSA, Trieste*, Italy.

Publications

Refereed Articles in Journals

- [15] **Continuum Kac–Moody Lie algebras**, with A. Appel and O. Schiffmann, *Moscow Mathematical Journal*, to appear.
[arXiv link]
- [14] **Two-dimensional categorified Hall algebras**, with M. Porta, *Journal of the European Mathematical Society*, to appear.
[arXiv link]
- [13] **Fock space representation of the circle quantum group**, with O. Schiffmann, *International Mathematics Research Notices IMRN*, 2021, no. 22, 17025–17070.
[Journal link], [arXiv link]
- [12] **Quantization of continuum Kac–Moody Lie algebra**, with A. Appel, *Pure and Applied Mathematics Quarterly*, 2020, 16, no. 3, 439–493.
[Journal link], [arXiv link]
- [11] **Cohomological Hall algebra of Higgs sheaves on a curve**, with O. Schiffmann, *Algebraic Geometry*, 2020, 7, no. 3, 346–376.
[Journal link], [arXiv link]
- [10] **The circle quantum group and the infinite root stack of a curve**, with O. Schiffmann and with an appendix by T. Kuwagaki, *Selecta Mathematica, New Series*, 2019, no. 5, Art. 77, 86 pp.
[Journal link], [arXiv link]
- [9] **Instantons and framed sheaves on Kähler Deligne–Mumford stacks**, with P. Eyssidieux, *Annales de la Faculté des Sciences de Toulouse. Mathématiques. Série 6*, 2018, 27, no. 3, 599–628.
[Journal link], [arXiv link]
- [8] **AGT relations for abelian quiver gauge theories on ALE spaces**, with M. Pedrini and R. J. Szabo, *Journal of Geometry and Physics*, 2016, 103, 43–89.
[Journal link], [arXiv link]
- [7] **Framed sheaves on root stacks and supersymmetric gauge theories on ALE spaces**, with U. Bruzzo, M. Pedrini, and R. J. Szabo, *Advances in Mathematics*, 2016, 288, 1175–1308.
[Journal link], [arXiv link]
- [6] **$\mathcal{N} = 2$ quiver gauge theories on A-type ALE spaces**, with U. Bruzzo and R. J. Szabo, *Letters in Mathematical Physics*, 2015, 105, no. 3, 401–445.
[Journal link], [arXiv link]
- [5] **Framed sheaves on projective stacks**, with U. Bruzzo and with an appendix by M. Pedrini, *Advances in Mathematics*, 2015, 272, 20–95.
[Journal link], [arXiv link]
- [4] **Restriction theorems for μ -(semi)stable framed sheaves**, *Journal of Pure and Applied Algebra*, 2013, 217, no. 12, 2320–2344.
[Journal link], [arXiv link]
- [3] **Symplectic structures on moduli spaces of framed sheaves on surfaces**, *Central European Journal of Mathematics*, 2012, 10, no. 4, 1455–1471.
[Journal link], [arXiv link]

Submitted Papers and Preprints

- [2] **Shuffle algebras for quivers as quantum groups**, with A. Neguț and O. Schiffmann.
[arXiv link]
- [1] **McKay correspondence, cohomological Hall algebras and categorification**, with D.-E. Diaconescu and M. Porta.
[arXiv link]
- [0] **Representations of the Heisenberg algebra and moduli spaces of framed sheaves**, with P. Tortella.
[arXiv link]

Editorial Work

- 2019 Editor (with U. Bruzzo and A. Grassi). “Geometric Representation Theory and Gauge Theory”. Cetraro, Italy 2018. Lecture Notes in Mathematics. Fondazione CIME/CIME Foundation Subseries. Springer, 2019
- 2017 Special Issue Managing Editor. “Interactions between Geometry and Physics. A topical issue in honor of Ugo Bruzzo’s 60th birthday”, *Journal of Geometry and Physics*, 2017, 118, 1–234
- 2016 Guest Editor (with U. Bruzzo). Special issue on “Instanton Counting: Moduli Spaces, Representation Theory and Integrable Systems”, *Journal of Geometry and Physics*, 2016, 109, 1–122

Selected Visiting Positions

- 2022 **MFO**, Oberwolfach, Germany.
Research in Pairs Program (2 weeks)
- 2021 **MFO**, Oberwolfach, Germany.
Research in Pairs Program (2 weeks)
- 2021 **IHÉS**, France.
(8 weeks)
- 2019 **SCGP**, Stony Brook, USA.
Program “Geometry and Physics of Hitchin Systems” (2 weeks)
- 2017 **SISSA**, Trieste, Italy.
(6 weeks)
- 2017 **Université de Paris-Saclay**, Paris, France.
(5 weeks)
- 2016 **IHÉS**, France.
(8 weeks)
- 2016 **SISSA**, Trieste, Italy.
(4 weeks)
- 2016 **Institut Henri Poincaré**, Paris, France.
Thematic trimester devoted to “Program on the mathematics of string theory” (8 weeks)
- 2015 **Université de Paris-Saclay**, Paris, France.
(5 weeks)
- 2014 **Laboratory of Algebraic geometry and its application, SU-HSE**, Moscow, Russia.
(4 weeks)
- 2014 **IHÉS**, France.
(6 weeks)
- 2014 **Institut Henri Poincaré**, Paris, France.
Research in Paris Program “AGT conjecture on ALE spaces by means of framed sheaves” (6 weeks)
- 2012 **SISSA**, Trieste, Italy.
(9 weeks)
- 2011 **IHÉS**, France.
(10 weeks)

Conference Talks

- 2019 **Algebra and Representation Theory in the North**, *University of Edinburgh*, UK.
- 2019 **XXI Congresso dell’Unione Matematica Italiana (Lie theory section)**, *Università degli Studi di Pavia*, Italy.
- 2019 **Cohomological Hall algebras in Mathematics and Physics**, *Perimeter Institute for Theoretical Physics*, Waterloo, Canada.
- 2018 **A conference on character varieties and quantisation**, *University of Auckland*, New Zealand.
- 2018 **VBAC 2018: Gauge Theory and Complex Geometry**, *CIRM*, Luminy, France.
(one-hour contributed talk)
- 2017 **Geometric Representation Theory**, *University of Glasgow*, UK.
- 2017 **Quantum groups, Special functions and Integrable systems**, *LMPT*, Tours, France.

- 2017 **Hitchin Systems in Mathematics and Physics**, *Perimeter Institute for Theoretical Physics*, Waterloo, Canada.
- 2016 **Christmas Workshop on Quivers, Moduli Spaces and Integrable Systems**, *Università degli Studi di Genova*, Italy.
- 2015 **Workshop on Algebraic Varieties**, *Fields Institute*, Toronto, Canada.
- 2014 **Workshop on DAHA, Hall Algebras, Torus Knots and Combinatorics**, *Université de Paris-Saclay*, Paris, France.
- 2013 **Workshop on Algebraic Analysis and Geometry**, *Università degli Studi di Padova*, Italy.
- 2012 **Christmas Workshop on Moduli Spaces and Integrable Systems**, *Università degli Studi di Genova*, Italy.
- 2012 **String-Math 2012**, *Hausdorff Center for Mathematics*, Bonn, Germany.
(20-min contributed talk)
- 2012 **Workshop on Geometry, Integrability, Quantization**, *SISSA*, Trieste, Italy.
- 2011 **4rd Workshop on Geometric Methods in Theoretical Physics**, *SISSA*, Trieste, Italy.
- 2010 **Workshop on Categorical Methods in Geometry and Gauge Theory**, *Chern Institute of Mathematics*, Nankai University, China.
- 2010 **3rd Workshop on Geometric Methods in Theoretical Physics**, *SISSA*, Trieste, Italy.

Colloquia

- 2019 Higher School of Economics, Moscow
- 2018 Hong Kong Geometry Colloquium
- 2017 SISSA - Trieste
- 2016 Kansas State University
- 2015 Georgia Southern University

Seminar Talks

- 2022 Virginia Commonwealth University (Geometry and Topology Seminar)
- 2021 UC Davis (Algebraic Geometry Seminar), Freie Universität Berlin (Algebraic Geometry and Complex Analysis Seminar)
- 2020 The RepNet Virtual Seminar, Università di Roma "Tor Vergata" (Algebra and Representation Theory Seminar), Università degli Studi di Bologna (Algebra and Geometry Seminar), Università di Pisa (Algebraic and Arithmetic Geometry Seminar)
- 2019 Università degli Studi di Firenze (Seminario di Geometria), University of Sheffield (Algebraic Geometry Seminar), University of York (Algebra Seminar), Kavli IPMU (GTM Seminar), Rutgers University (Geometry, Symmetry and Physics Seminar), Northeastern University (Geometry, Physics, and Representation Theory Seminar)
- 2018 University of Edinburgh (EDGE Seminar), Université de Strasbourg (Séminaire Quantique), Université de Grenoble (Séminaire de Algèbre et Géométries), Scuola Normale Superiore - Pisa, Università degli Studi di Firenze (Seminario di Geometria), Kavli IPMU (GTM Seminar)
- 2017 Rutgers University (Geometry, Symmetry and Physics Seminar), MIT (Geometric Representation Theory), Centre for Quantum Geometry of Moduli Spaces - Aarhus (Aarhus Differential Algebraic Geometry Seminars), Department of Physics and Astronomy - Uppsala University, Institut de Mathématiques de Jussieu and ENS - Paris (Séminaire de Géométrie Algébrique), Institut de Mathématiques de Bourgogne - Dijon (Séminaire de Géométrie et Systèmes Dynamiques), Institut Henri Poincaré - Paris (Séminaire de Géométrie et Quantification), Institut Élie Cartan de Lorraine (Séminaire de Analyse, Géométrie et Algèbre), Kavli IPMU (GTM Seminar)
- 2016 University of Waterloo (Geometry and Topology Seminar), Université Lille 1 (Séminaire de Géométrie Algébrique), Université d'Angers (Séminaire de Géométrie Algébrique), SISSA - Trieste (Geometry Seminar), Università degli Studi di Torino (Seminari di Algebra e Geometria Algebrica), University of British Columbia (Algebra and Algebraic Geometry Seminar), Institut de Mathématiques de Jussieu - Paris (Séminaire Groupes, Représentations et Géométrie), Université de Grenoble (Séminaire de Algèbre et Géométries)

- 2015 Perimeter Institute for Theoretical Physics (Geometric Representation Theory Seminar), Fields Institute - Toronto (Geometric Representation Theory Seminar), University of Pennsylvania (Math-Physics Joint Seminar), Rutgers University (Geometry, Symmetry and Physics Seminar), University of Western Ontario (Geometry and Topology Seminar, Noncommutative Geometry Seminar and Algebra Seminar)
- 2014 LPTHE - Université Pierre et Marie Curie - Paris, University of Waterloo (Geometry and Topology Seminar), University of Western Ontario (Geometry and Topology Seminar), SISSA - Trieste (Geometry Seminar), Laboratory of Algebraic geometry and its application - SU-HSE - Moscow (Geometric Representation Theory Seminar and Seminar on Geometric Structures on Manifolds), Université de Nice Sophia-Antipolis (Séminaire d'Algèbre, Topologie et Géométrie), University of Luxembourg (Seminar in Algebra, Geometry, and Quantization), Université de Rennes 1 (Séminaire de Géométrie Algébrique), Institut de Mathématiques de Jussieu - Paris (Séminaire Caen Cergy Clermont Paris - Théorie des Représentations and Séminaire de Géométrie Algébrique), University of Edinburgh (EDGE Seminar)
- 2013 Maxwell Institute for Mathematical Sciences - Edinburgh, Université d'Angers (Séminaire de Physique Mathématique), Université de Grenoble (Séminaire de Algèbre et Géométries)
- 2012 Maxwell Institute for Mathematical Sciences - Edinburgh, Université Lille 1 (Séminaire de Géométrie Algébrique), SISSA - Trieste (Students' Seminar in Algebraic Geometry - expository talk)
- 2011 Université Lille 1 (Séminaire de Géométrie Algébrique), Université d'Angers (Séminaire de Physique Mathématique), Université de Grenoble (Séminaire de Algèbre et Géométries), Université de Nantes (Séminaire de Topologie, Géométrie et Algèbre)

Organizational Activities

Conferences, Workshops, and Schools

- 2022 **Ricercatori in Algebra e Geometria 2022** (organized with A. Appel, A. Lerario, S. Scherotzke, N. Sibilla, and M. Talpo), *SISSA*, Trieste, Italy.
- 2022 **Workshop on "Geometry and Arithmetics of Moduli Spaces"** (organized with A. Bandini, T. Szamuely, and M. Talpo), *Università di Pisa*, Pisa, Italy.
- 2022 **"Geometric Representation Theory", virtual ICM 2022 Satellite Conference** (organized with T. Arakawa, J. Kamnitzer, H. Nakajima, M. Reineke, and V. Serganova), *Kavli IPMU*, Tokyo, Japan.
- 2022 **CIRM Workshop on "New Perspectives on Hyperkähler Manifolds". A Celebration of Dimitri Markushevich's (60+2)nd Birthday** (organized with U. Bruzzo and G. Menet), *CIRM*, Levico Terme, Italy.
- 2021 **Ricercatori in Algebra e Geometria 2020** (organized with A. Appel, A. Hochenegger, M. Porta, S. Scherotzke, and M. Talpo), *Scuola Normale Superiore*, Pisa, Italy.
(Postponed from 2020 to 2021 due to the COVID-19 pandemic)
- 2021 **IHÉS Summer School on Enumerative Geometry, Physics and Representation Theory** (organized with A. Negut and O. Schiffmann), *IHÉS*, France.
School offered in a blended format with around 350 participants
- 2021 **Quantization in Derived Algebraic Geometry and Representation Theory** (organized with A. Appel, M. Porta, and O. Schiffmann), *BIRS - Casa Matematica Oaxaca*, Mexico.
(Cancelled due to the COVID-19 pandemic.)
- 2019 **Moduli spaces, Representation theory and Quantization** (organized with D. Baraglia, P. Hekmati, T. Mochizuki, and M.-H. Saito), *RIMS*, Kyoto, Japan.
- 2019 **Representation Theory, Gauge Theory, and Integrable Systems** (organized with H. Nakajima, Y. Tachikawa, and Y. Yoshida), *Kavli IPMU*, Japan.
- 2018 **CIME School on Geometric Representation Theory and Gauge Theory** (organized with U. Bruzzo and A. Grassi), *Cetraro*, Italy.
- 2017 **School and Workshop on Higgs moduli spaces and character varieties (SWAGP2017)** (organized with U. Bruzzo, F. Rodriguez Villegas, and J. Stoppa), *SISSA*, Trieste, Italy.
- 2017 **Workshop "From students to mathematicians: an excellence Master program in Trieste"** (organized with D. Barilari, F. Fanelli, A. Lerario, et al.), *SISSA and Università degli Studi di Trieste*, Italy.

- 2016 **Hall algebras, enumerative invariants and gauge theories** (organized with J. Kamnitzer and O. Schiffmann), *Fields Institute*, Toronto, Canada.
- 2015 **Moduli Spaces in Algebraic Geometry and Mathematical Physics** (organized with U. Bruzzo, E.-D. Diaconescu, F. Perroni, and C. Bai), *Chern Institute of Mathematics*, Tianjin, China.
- 2015 **Interactions between Geometry and Physics. A conference in honor of Ugo Bruzzo's 60th birthday** (organized with M. Jardim, F. Perroni, et al.), Guarujá, São Paulo, Brazil.
- 2014 **Instanton Counting: Moduli Spaces, Representation Theory and Integrable Systems** (organized with U. Bruzzo, D. Markushevich, V. Rubtsov, and S. Shadrin), *Lorentz Center*, Leiden, The Netherlands.
- 2013 **VBAC2013 (2013 meeting of the Vector Bundles on Algebraic Curves Group). Hilbert Schemes, Sheaves and Representation Theory** (organized with U. Bruzzo, et al.), *SISSA*, Trieste, Italy.

Online Seminars

- 2021–2021 **(Italian) Online Representation Theory Seminar** (co-organizer), website: grt.cs.dm.unipi.it/online-representation-theory-seminar.
- 2020–2021 **Geometry and Representation Theory at Home** (co-organizer), website: grt-home.org.

Departmental Seminars

- 2021–Present **Departmental Colloquia** (co-organizer), *Università di Pisa*, Italy.
- 2020–Present **Seminar on Combinatorics, Lie Theory, and Topology** (co-organizer), *Università di Pisa*, Italy.
- 2015–2016 **Geometry and Topology Seminar** (co-organizer), *University of Western Ontario*, Canada.

Supervision

Ph.D. Students

- 2021–Present **Luca Bruni**, *Scuola Normale Superiore (Pisa, Italy)*.
- 2010–2013 **Mattia Pedrini** (supervised with U. Bruzzo), *SISSA (Trieste, Italy)*, Thesis: *Moduli spaces of framed sheaves on stacky ALE spaces, deformed partition functions and the AGT conjecture*.
Presently, Data Scientist at CGnal, Milan, Italy

Master's Degree Thesis

- 2023 **Davide Ferri**, *Università di Pisa (Italy)*, in progress.
joint degree with Hokkaido University, supervised by Shibukawa Youichi

Bachelor's Degree Thesis

- 2021 **Edoardo Ciminelli**, *Università di Pisa (Italy)*, in progress.
- 2021 **Davide Chionna**, *Università di Pisa (Italy)*, Thesis: *Classificazione delle algebre di Lie semisemplici su campi algebricamente chiusi*, defended in September, 2021.
- 2021 **Nicolò Bignami**, *Università di Pisa (Italy)*, Thesis: *Rappresentazioni di quivers e teorema di Gabriel*, defended in September, 2021.
- 2021 **Chiara Valentina Gaetano**, *Università di Pisa (Italy)*, Thesis: *Fibrati vettoriali, classi di Chern e la loro relazione con la coomologia della Grassmanniana*, defended in May, 2021.

Teaching - Graduate Courses - PhD Level

- 2021 **Yangians in geometry and representation theory**, *Università di Pisa*, Italy.
Joint course with *Università di Parma* and *Università di Roma Tor Vergata*.
- 2009–2010 **Sheaf theory and metrics on fiber bundles**, (*Teaching assistant*), *SISSA*, Italy.

Teaching - Università di Pisa, Italy

- 2021–2022 **Analisi Matematica 1**.
Laurea Triennale in Ingegneria Biomedica
- 2020–2021 **Analisi Matematica 1**.
Laurea Triennale in Ingegneria Biomedica

2019–2020 **Geometria 2.**
Laurea Triennale in Matematica

Teaching - University of Western Ontario, Canada

- 2016 **Math 1228 B**, *Methods of Finite Mathematics*.
- 2015 **Math 1229 A**, *Methods in Matrix Algebra*.
- 2015 **Calculus 1301 B**, *Calculus II*.
- 2014 **Math 1229 A**, *Methods in Matrix Algebra*.

Teaching - Università degli Studi di Trieste, Italy

2010–2011 **Algebra I**, (*Teaching assistant*).
Laurea Triennale in Matematica

Other Academic Activities

Referee

Adv. Math., Bull. Sci. Math., Comm. Math. Phys., Épijournal Geom. Algébrique, Int. Math. Res. Not. IMRN, J. Algebra, J. Algebraic Geom., J. Geom. Phys., J. Inst. Math. Jussieu, J. Pure Appl. Algebra, Lett. Math. Phys., Math. Res. Lett., Math. Z., Proc. Edinburgh Math. Soc, Sel. Math. New Ser., Mosc. Math. J., SIGMA, Tunis. J. Math.

Reviewer

NWO Talent Program (2022)

Ph.D. defense committee member

2021 **Lucien Hennecart**, *Université de Paris-Saclay*, Paris, France.

University and Departmental Services

- 2014–2015 **International Postdoctoral Representative at the Postdoctoral Association at Western**, *University of Western Ontario*, Canada.
- 2008–2011 **Students' Representative at the Mathematical Physics Sector**, *SISSA*, Trieste, Italy.
- 2006–2008 **Students' Representative at the Dipartimento di Matematica**, *Università degli Studi di Trieste*, Italy.

Memberships

- 2009–Present **GNSAGA–INdAM**.
- 2013–2016 **PRIN “Geometria delle Varietà Algebriche”**, co-funded by MIUR (cofin 2010).
- 2010–2012 **PRIN “Problemi di classificazione e moduli in geometria algebrica”**, co-funded by MIUR (cofin 2008).

Languages

Italian	Mother tongue
English	Fluent knowledge
French	Fair knowledge
Spanish	Fair knowledge

Updated on April 28th, 2022