

# Carlo Collari

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## Education

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### Università degli studi di Firenze

PH.D. IN MATHEMATICS (DOTTORATO)

Thesis: Transverse invariants from the deformations of Khovanov  $\mathfrak{sl}_2$ - and  $\mathfrak{sl}_3$ -homologies

Advisor: Prof. Paolo Lisca

Florence, Italy

Dec. 2013 - Mar. 2017

### Università di Pisa

M.SC. IN MATHEMATICS (LAUREA SPECIALISTICA)

Thesis: The functoriality of Khovanov homology and the monodromy of knots

Advisor: Prof. Paolo Lisca

Final Grade: 110/110 Cum Laude

Pisa, Italy

Sep. 2010 - Oct. 2013

### Università degli studi di Cagliari

B.SC. IN MATHEMATICS (LAUREA TRIENNALE)

Thesis: Forme differenziali ed applicazioni

Advisor: Prof. Andrea Loi

Final Grade: 110/110 Cum Laude

Cagliari, Italy

Lug. 2007 - Sep. 2010

### Université de Strasbourg

LLP ERASMUS

Strasbourg, France

Sep. 2009 - Lug. 2010

### Liceo Scientifico "E. Fermi"

HIGH SCHOOL DIPLOMA

Final Grade: 100/100

Nuoro, Italy

Sep. 2002 - Lug. 2007

## Positions

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### New York University in Abu Dhabi

POST-DOC ASSOCIATE

- Mentor: Dr. Qingtao Chen

Abu Dhabi, UAE

29 May 2019 - 28 May 2021

### Alfréd Rényi Institute for Mathematics

VISITING ASSISTANT PROFESSOR (TUDOMÁNYOS FŐMUNKATÁRS)

- Supervisor: Prof. András Stipsicz

Budapest, Hungary

Mar. 2018 - Jun. 2018

Jan. 2019 - Feb. 2019

### Durham University

VISITING POST-DOC

- Funded by a joint scholarship Accademia dei Lincei/Royal Society
- Supervisor: Prof. Andrew J. Lobb

Durham, United Kingdom

Jul. 2018 - Nov. 2018

### Université de Toulouse III "Paul Sabatier"

VISITING POST-DOC

- Funded by Indam
- Supervisor: Prof. Francesco Costantino

Toulouse, France

Nov. 2017 - Jan. 2018

## Research

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### PAPERS

**Symmetric union diagrams and refined spin models**, *Canad. Math. Bull.*, DOI: 10.4153/S0008439518000115

(arxiv: 1804.09157)

with P. Lisca

**A Bennequin-type inequality and combinatorial bounds**, accepted for publication in the *Michigan Math.*

*J.*, (arxiv: 1707.03424)

**On transverse invariants from Khovanov-type homologies**, *J. Knot Theory Ramifications* 28 (2019), no. 1,

1950012, 37 pp. DOI:10.1142/S0218216519500123 (arxiv: 1705.03481)

**Slice-torus concordance invariants and Whitehead doubles of links**, accepted for publication in the

*Canad. J. Math.*, DOI:10.4153/S0008414X19000294 (arxiv: 1806.10358)

with A. Cavallo

## PRE-PRINTS

**On symmetric equivalence of symmetric union diagrams**, arxiv: 1901.10270

*with P. Lisca*

**Transverse link invariants from the deformations of Khovanov  $\mathfrak{sl}_3$ -homology**, arxiv: 1806.00752

## RESEARCH INTERESTS

I am interested in low-dimensional topology and geometry, with a focus on knot theory. My research up to now has been centred around knot homologies, quantum invariants, and their applications. I am currently working (also in collaboration) on various projects concerning Khovanov-Rozansky  $\mathfrak{sl}_N$ -homologies and their deformations, quantum invariants, the study of knot and link concordance from different perspectives, and virtual knots and links. Here is a small list of topics I am interested in

- Properties of Khovanov-Rozansky homologies and their deformations;
- Concordance of knots and links, obstructions to sliceness, slice genus computations and slice-torus invariants;
- Computation and categorification of quantum invariants;
- Invariants for graphs in three dimensional spaces;
- Invariants for surfaces in four dimensional spaces;
- Invariants for transverse knots and links arising from link homologies, and their applications;
- Link homologies for virtual knots, and applications to the study of their concordance;
- Spacification of link homologies and their properties.

## Awards, Grants & Scholarships

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### SCHOLARSHIPS AND GRANTS

Mar. 2018 **Joint scholarship Accademia dei Lincei/Royal Society**, for 5 months at the University of Durham

Sep. 2017 **Indam grant for a research period outside Italy**, for 3 months at the IMT of Toulouse

2013-2016 **Ph.D. fellowship**, co-funded by Università degli studi di Firenze · Università di Perugia · Indam

2007-2012 **Sardinian regional scholarship for outstanding students**, renewed on yearly basis

### AWARDS

2004 **National award INAIL-MIUR**, for projects concerning the security at the work place

## Teaching Activity (Undergraduate)

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### Università di Pisa, School of Engineering, Aerospace Engineering

*Pisa, Italy*

TEACHING ASSISTANT

- Linear Algebra (30 Mar. 2017 · 30 Apr. 2017)

### Università di Pisa, School of Engineering, Telecommunications Engineering

*Pisa, Italy*

TUTOR

- Linear Algebra, and Calculus II (30 Sep. 2016 · 21 Dec. 2016)
- Linear Algebra, and Calculus II (12 Apr. 2016 · 12 Aug. 2016)
- Linear Algebra, and Calculus II (16 Nov. 2015 · 01 Dec. 2015)

### Università di Pisa, Department of Physics

*Pisa, Italy*

TUTOR

- Geometry I (Linear Algebra) (01 Dec. 2015 · 19 Dec. 2015)

### Università di Pisa, Department of Mathematics

*Pisa, Italy*

TUTOR

- Generic Tutoring for the First Year (01 Nov. 2013 · 21 Dec. 2013)
- Elements of Mathematical Analysis (01 Nov. 2013 · 21 Dec. 2013)

## Conferences Attended

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Mar. 2019	<b>Chekanov-Eliashberg algebra and knot invariants</b> , Alfréd Rényi Institute	Budapest, Hungary
Feb. 2018	<b>WinterBraids IX</b> , Université de Reims Champagne-Ardenne	Reims, France
Jul. 2018	<b>Gauge theory and applications</b> , Universität Regensburg	Regensburg, DE
Jan. 2018	<b>Khovanov Homotopy Type</b> , Alfréd Rényi Institute	Budapest, Hungary
May 2017	<b>Thematic School on Quantum Topology and Geometry</b> , Université de Toulouse III	Toulouse, France
Apr. 2017	<b>SMI course "Kähler-Einstein metrics"</b> , Palazzone	Cortona, Italy
Feb. 2017	<b>PRIN Workshop on Geometry, Topology and Harmonic Analysis</b> , Scuola Normale Superiore	Pisa, Italy
Jul. 2016	<b>Floer theories and low dimensional topology</b> , Universität Regensburg	Regensburg, DE
Jul. 2016	<b>CEU Summer school in low-dimensional Topology</b> , Alfréd Rényi Institute	Budapest, Hungary
Jun. 2016	<b>ECSTATIC II</b> , Imperial College	London, U.K.
Feb. 2016	<b>WinterBraids VI</b> , Université de Lille	Lille, France
Jun. 2015	<b>ECSTATIC</b> , Imperial College	London, U.K.
Feb. 2015	<b>WinterBraids V</b> , Université de Pau et Pays de l'Adour	Pau, France
Dec. 2014	<b>Perspectives in Lie Theory</b> , Centro di Ricerca "Ennio de Giorgi"	Pisa, Italy
Aug. 2014	<b>The 10<sup>th</sup> William Rowan Hamilton Geometry and Topology Workshop</b> , Trinity College	Dublin, Ireland

## Selected List of Talks, Seminars & Lectures

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### LECTURES

May 2017	<b>Two lectures on Khovanov's <math>\mathfrak{sl}_3</math>-homology via foams and its deformations</b> , Alfréd Rényi Institute	Budapest, Hungary
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### CONFERENCE TALKS

Mar. 2019	<b>Symmetric union knots and how to distinguish them</b> , Chekanov-Eliashberg algebra and knot invariants	Budapest, Hungary
Jan. 2018	<b>On combinatorial bounds for Rasmussen's <math>s</math>-invariant</b> , Khovanov Homotopy Type	Budapest, Hungary
Feb. 2017	<b>Contact Invariants from Khovanov-type homologies</b> , PRIN Workshop	Pisa, Italy
Jun. 2015	<b>Invariants for transverse knots from Khovanov-type homologies</b> , ECSTATIC	London, U.K.

### SEMINAR TALKS

May 2019	<b>Slice-torus invariants and applications</b> , Oberseminar Geometrie und Globale Analysis	Regensburg, DE
May 2019	<b>An introduction to the <math>\mathfrak{sl}_3</math> link homology</b> , LKS Seminars	Regensburg, DE
Nov. 2018	<b>Slice-torus invariants and applications</b> , G & T Seminar	Glasgow, U.K.
Jan. 2019	<b>Bracket polynomial: applications and generalisations</b> , GATEAWAY Seminar	Warwick, U.K.
Dec. 2018	<b>Transverse invariants from Khovanov <math>\mathfrak{sl}_3</math>-homology</b> , Seminari di Geometria e Analisi Complessa	Florence, Italy
Nov. 2018	<b>On slice-torus invariants and applications</b> , G & T Seminar	Glasgow, U.K.
Oct. 2018	<b>Transverse invariants from the deformations of Khovanov <math>\mathfrak{sl}_3</math>-homology</b> , Seminario di Geometria	Pisa, Italy
Oct. 2018	<b>Slice-torus link invariants</b> , G & T Seminar	Durham, U.K.
May 2018	<b>Slice-torus link invariants and Whitehead doubles</b> , Seminario di Geometria	Pisa, Italy
Feb. 2018	<b>On concordance and related problems</b> , Baby-Geometri	Pisa, Italy
Feb. 2017	<b>On a Bennequin-type inequality from Bar-Natan homology</b> , LKS Seminars	Regensburg, DE
Mar. 2016	<b>Combinatorial invariants of knots</b> , Seminari di Geometria	Cagliari, Italy
Mar. 2015	<b>Topological Quantum Field Theories</b> , Baby-Geometri	Pisa, Italy
Mar. 2014	<b>Quandles and minimal colourings of knots</b> , Baby-Geometri	Pisa, Italy
Nov. 2012	<b>Handle decomposition of Lefschetz fibrations</b> , Baby-Geometri	Pisa, Italy

## Service Experience

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<b>Referee</b>	for international math journals (since 2017)
<b>Reviewer</b>	ZbMath
<b>Organiser</b>	Baby-Geometri Seminar, Dept. of Math., Pisa (2014 · 2017)
<b>Student Representative</b>	for master students in Mathematics, Dept. of Math., Pisa (2011 · 2012)

## Memberships

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Since 2013 **Indam (GNSAGA)**, national institute for higher mathematics (geometry and algebra group)  
 2010-2014 **Made@DM**, a society for the diffusion of science

## Outreach

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I was a member of the **Made@DM**, an association for the diffusion of Mathematics and Science. With the **Made@DM** I co-organised, and contributed, to various exhibitions which aim was to present mathematical concepts to student of various ages and to the general public.

2013 **Tessere e Colori (Tiles and Colours)**, co-organiser  
2012 **Poliedri in Pezzi (Polyhedra into Pieces)**, collaborator  
2012 **Polyhedra into Pieces**, collaborator  
2011 **A tu per tu con la Matematica (Face to face with Mathematics)**, co-organiser

*La Limonaia, Pisa*  
*La Limonaia, Pisa*  
*Liceo Ruscoli, Pisa*  
*La Limonaia, Pisa*

## Skills

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**Programming** Python, C/C++, PostScript, LaTeX, Visual Basic 5 & 6, HTML 4 & 5  
**Operative Systems** Windows, Ubuntu, Kubuntu, Debian  
**Languages** Italian (Native), English (Fluent), French (Fluent)