

# Luca Carai

*Citizenship:* Italian

*Address:* Dipartimento di Matematica ‘Federigo Enriques’, Università degli Studi di Milano  
via Cesare Saldini 50, 20133 Milan, Italy.

*E-mails:* luca.carai@unimi.it  
luca.carai.uni@gmail.com

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## PROFESSIONAL EXPERIENCE

*Junior assistant professor (fixed-term)*

*Ricercatore a tempo determinato di tipo A* in the Italian system  
Università degli Studi di Milano, Italy. September 2023 – ongoing

*Juan de la Cierva postdoc fellow.* Universitat de Barcelona, Spain. December 2022 – August 2023

*Postdoctoral researcher.* Università degli Studi di Salerno, Italy. July 2021 – November 2022

## EDUCATION

*Ph.D.*

Mathematics

New Mexico State University, Las Cruces, USA

Advisor: Prof. Guram Bezhanishvili

Thesis: “New directions in duality theory for modal logic”

August 2017–May 2021

*Master’s degree*

Mathematics

Università degli Studi di Milano, Milan, Italy

Advisor: Prof. Silvio Ghilardi

Thesis: “Model completion of varieties of Heyting algebras and Brouwerian semilattices”

October 2014–December 2016

Final grade: 110/110 cum Laude

## QUALIFICATIONS

- Italian National Scientific Habilitation (ASN) to serve as Associate Professor in Mathematical Logic (Logica Matematica e Matematiche Complementari, 01/A1).
- Catalan habilitation to serve as Professor Lector issued by the Catalan University Quality Assurance Agency (AQU Catalunya)

## PUBLICATIONS

### PUBLISHED/ACCEPTED

1. N. Bezhanishvili, L. Carai, S. Ghilardi, and Z. Zhao, *A calculus for modal compact Hausdorff spaces*, Accepted for publication in the Journal of Logic and Computation, preprint at arXiv:2402.00528, 2024.
2. G. Bezhanishvili, L. Carai, and P. J. Morandi, *Connecting generalized Priestley duality to Hofmann-Mislove-Stralka duality*, Theory Appl. Categ. **41** (2024), no. 54, 1937-1982

3. G. Bezhanishvili and L. Carai, *Failure of the Blok-Esakia Theorem in the monadic setting*, Ann. Pure Appl. Log. **176** (2025), no. 4, 103527
4. M. Abbadini, G. Bezhanishvili, and L. Carai, *Vietoris endofunctor for closed relations and its de Vries dual*, Top. Proc. **64** (2024), 213–250
5. M. Abbadini, G. Bezhanishvili, and L. Carai, *MacNeille completions of subordination algebras*, Cah. Topol. Géom. Différ. Catég. **LXV** (2024), no. 2, 151–199
6. G. Bezhanishvili, L. Carai, P.J. Morandi, *A New Proof of the Joyal-Tierney Theorem*, Cah. Topol. Géom. Différ. Catég. **LXIV** (2023), no. 4, 425–438
7. G. Bezhanishvili, L. Carai, and P.J. Morandi, *A frame-theoretic perspective on Esakia duality*, Algebra Univers. **84** (2023), no. 30.
8. M. Abbadini, G. Bezhanishvili, and L. Carai, *A generalization of de Vries duality to closed relations between compact Hausdorff spaces*, Topology Appl. **337** (2023), Paper No. 108641
9. G. Bezhanishvili, L. Carai, P.J. Morandi, and B. Olberding, *A unified approach to Gelfand and de Vries dualities*, Forum Math. **35** (2023), no. 3, 647–676
10. G. Bezhanishvili, L. Carai, P.J. Morandi, and B. Olberding, *De Vries powers and proximity Specker algebras*, Appl. Categ. Structures **31** (2023), no. 3, Paper No. 24
11. N. Bezhanishvili, L. Carai, S. Ghilardi, and L. Landi, *Admissibility of  $\Pi_2$ -inference rules: interpolation, model completion, and contact algebras*, Ann. Pure Appl. Logic **174** (2023), no. 1, Paper No. 103169
12. G. Bezhanishvili, L. Carai, and P.J. Morandi, *A Point-Free Approach to Canonical Extensions of Boolean Algebras and Bounded Archimedean  $\ell$ -Algebras*, Order **40** (2023), no. 2, 257–287
13. G. Bezhanishvili and L. Carai, *Temporal interpretation of monadic intuitionistic quantifiers*, Rev. Symb. Log. **16** (2023), no. 1, 164–187
14. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Duality for powerset coalgebras*, Log. Methods Comput. Sci. **18** (2022), no. 1
15. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Modal operators on rings of continuous functions*, J. Symb. Log. **87** (2022), no. 4, 1322–1348
16. G. Bezhanishvili, L. Carai, and P.J. Morandi, *The Vietoris functor and modal operators on rings of continuous functions*, Ann. Pure Appl. Log. **173** (2022), no. 1, 103029
17. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Free bounded archimedean  $\ell$ -algebras*, Appl. Categ. Struct. **29** (2021), no. 5, 879–888
18. G. Bezhanishvili, N. Bezhanishvili, L. Carai, D. Gabelaia, S. Ghilardi, and M. Jibladze, *Diego’s theorem for nuclear implicative semilattices*, Indag. Math. (N.S.) **32** (2021), no. 2, 498–535
19. G. Bezhanishvili and L. Carai, *Temporal interpretation of intuitionistic quantifiers*, Advances in Modal Logic, vol. 13, College Publications, 2020, pp. 95–114
20. L. Carai and S. Ghilardi, *Existentially closed Brouwerian semilattices*, J. Symb. Log. **84** (2019), no. 4, 1544–1575
21. G. Bezhanishvili and L. Carai, *Characterization of metrizable Esakia spaces via some forbidden configurations*, Algebra Univers. **80** (2019), no. 4, Paper No. 42, 18

## SUBMITTED

22. G. Bezhanishvili and L. Carai, *Failure of Esakia’s theorem in the monadic setting*, submitted, preprint available at arXiv:2409.05607, 2024.
23. L. Carai and T. Moraschini, *On the universal theory of the free pseudocomplemented distributive lattice*, submitted, preprint available at arXiv:2409.03640, 2024.
24. L. Carai *Free algebras and coproducts in varieties of Gödel algebras*, submitted, preprint available at arXiv:2406.05480, 2024.

25. L. Carai, M. Kurtzhals, and T. Moraschini, *Epimorphisms between finitely generated algebras*, submitted, preprint available at arXiv:2402.14745, 2024.
26. L. Carai, S. Lapenta, and L. Spada, *Baker-Beynon duality beyond semisimplicity*, submitted, preprint available at arXiv:2310.13427, 2023.

## TALKS AT CONFERENCES AND WORKSHOPS

### INVITED

- *Extending the Blok-Esakia Theorem to the monadic setting*  
TACL 2024, Barcelona, Spain, 1-5 July 2024.
- *Free algebras and coproducts in varieties of Gödel algebras*  
Barcelona Mathematical Days 2023, Barcelona, Spain, 2-3 November 2023.
- *Baker-Beynon duality beyond semisimplicity*  
Algebra Week 2023, Siena, Italy, 4-7 July 2023.
- *Dualities for abelian  $\ell$ -groups and vector lattices beyond archimedeanity*  
AMS Spring Western Sectional Meeting, Algebraic Logic session, 14-15 May 2022, online.
- *Dualities for abelian  $\ell$ -groups and vector lattices beyond archimedeanity*  
Ordered Algebras and Logic, Les Diablerets, Switzerland, 30 March-2 April 2022.
- *Connecting dualities for compact Hausdorff spaces*  
DOCToR workshop, 7-9 July 2021, online.
- *Coalgebras for the powerset functor and Thomason duality*  
2021 North American Annual Meeting of the ASL, Non-classical logic session 22-25 June 2021, online.
- *Esakia's theorem in the monadic setting*  
BLAST 2021, Las Cruces, USA, 9-13 June 2021, online.

### CONTRIBUTED

- *A calculus for modal compact Hausdorff spaces*  
XXVIII Incontro di Logica AILA, Udine, Italy, 3-6 September 2024.
- *Ideal and MacNeille completions of subordination algebras*  
LATD 2023, Tbilisi, Georgia, 11-15 September 2023.
- *Modal companions of monadic intuitionistic logic*  
XXII Congresso UMI, Pisa, Italy, 4-9 September 2023.
- *Deriving Priestley and Esakia dualities and their generalizations from Pontryagin duality for semilattices*  
Logic Colloquium 2023, Milan, Italy, 5-9 June 2023.
- *Admissibility of  $\Pi_2$ -Inference Rules: interpolation, model completion, and contact algebras*  
TACL 2022, Coimbra, Portugal, 20-24 June 2022.
- *Admissibility of  $\Pi_2$ -Inference Rules: interpolation, model completion, and contact algebras*  
Logic4Peace, Amsterdam, Netherlands, 22-23 April 2022, online.
- *Temporal interpretation of intuitionistic quantifiers*  
AiML 2020, Helsinki, Finland, 24-28 August 2020, online.
- *Modal operators on rings of continuous functions*  
25th Joint UTEP/NMSU Workshop, El Paso, USA, 2 November 2019.
- *A temporal interpretation of intuitionistic quantifiers*  
TACL 2019, Nice, France, 17-21 June 2019.

- *Characterization of metrizable Esakia spaces via some forbidden configurations*  
SYSMICS 2019, Amsterdam, Netherlands, 21–25 January 2019.
- *Existentially closed Brouwerian semilattices*  
TACL 2017, Prague, Czech Republic, 26–30 June 2017.

## SEMINAR TALKS

- *Free algebras and coproducts in varieties of Gödel algebras*  
LAC Seminar, University of Milan, Milan, Italy, 7 November 2024.
- *Extending the Blok-Esakia Theorem to the monadic setting*  
Seminari Lògiques No-Clàssiques, University of Barcelona, Spain, 20 March 2024.
- *La dualità di Baker-Beynon oltre la semisemplicità*  
Università degli Studi di Milano, Milan, Italy, 27 February 2024.
- *Subordination algebras and closed relations between compact Hausdorff spaces*  
Seminari Lògiques No-Clàssiques, University of Barcelona, Spain, 10 May 2023.
- *Baker-Beynon and Marra-Spada dualities beyond semisimplicity*  
Università degli Studi di Salerno, Salerno, Italy, 6 May 2022.
- *Dualities for MV-algebras*  
Università degli Studi di Campania Luigi Vanvitelli, Caserta, Italy, 11 March 2022.
- *Modal operators on rings of continuous functions*  
Nonclassical Logic Webinar, University of Denver, USA, 20 November 2020, online.
- *Temporal interpretation of intuitionistic quantifiers*  
Algebra|Coalgebra Seminar, University of Amsterdam, Netherlands, 10 June 2020, online.
- *A Generalization of Gelfand Duality to compact Hausdorff spaces with continuous relations*  
Algebra seminar, New Mexico State University, Las Cruces, USA, 30 September 2019.
- *Characterization of metrizable Esakia spaces via some forbidden configurations*  
Algebra seminar, New Mexico State University, Las Cruces, USA, 15, 22 October 2018.

## TEACHING

- *Matematica*, Fall 2023, Department of Food, Environmental and Nutritional Sciences, University of Milan.
- Teaching assistant for *Computational Logic* by S. Ghilardi, Fall 2023 and Fall 2024, Artificial Intelligence program, University of Milan.
- *Matematica I*, Spring 2022, Department of Industrial Engineering, University of Salerno.
- *Matrix Theory and Applied Linear Algebra*, Fall 2020 and Spring 2021, New Mexico State University.
- *Introduction to Ordinary Differential Equations*, Fall 2019 and Spring 2020, New Mexico State University.
- *Calculus I*, Spring 2019, New Mexico State University.
- *Trigonometry and pre-calculus*, Fall 2018, New Mexico State University.
- Teaching assistant for *Calculus II Honors* by G. Bezhanishvili, Spring 2018 and Spring 2021, New Mexico State University.

## TUTORING

- *Matematica I* by M. Abbadini and S. Lapenta, Fall 2021, Università degli Studi di Salerno.
- *Introduction to Real Analysis II* by T. Giorgi, Spring 2018, New Mexico State University.
- *Introduction to Real Analysis I* by T. Giorgi, Fall 2017, New Mexico State University.
- *Algebra I* by P. J. Morandi, Fall 2017, New Mexico State University.

## SUPERVISING

- Co-advisor, with T. Moraschini, for the Ph.D. thesis “Definability in logic and algebra” of M. Kurtzhals at the University of Barcelona, in progress.
- Co-advisor, with T. Moraschini, for the master’s thesis “Epimorphism surjectivity in logic and algebra” of M. Kurtzhals at the University of Barcelona, July 2024.
- Co-advisor, with L. Spada, for the bachelor’s thesis “Semantica algebrica della logica proposizionale intuizionista” of A. Cardone at the University of Salerno, December 2022.

## RESEARCH VISITS

- 3–13 April 2024. University of Salerno (prof. Luca Spada).
- 4–22 March 2024. University of Barcelona (prof. Tommaso Moraschini).

## PROJECTS

- Member of the project: PID2022-141529NB-C21 “La forma del razonamiento: desde el clasico al nonclasico y al revés”. P.I. Prof. T. Moraschini (University of Barcelona, Spain). Funded by the Spanish Ministry of Science, Innovation and Universities.
- Member of the project: PRIN 20173WKCM5\_002. P.I. Prof. L. Spada (University of Salerno, Italy). Funded by the Italian Ministry of Education, University and Research.

## AWARDS, SCHOLARSHIPS, AND TRAVEL GRANTS

- *Arts and Sciences Outstanding Graduate Award* from New Mexico State University, Spring 2021.
- *Kist award: oustanding graduate student award in research* from Department of Mathematical Sciences of New Mexico State University, Fall 2020.
- *Graduate Tuition Fellowship* from New Mexico State University, Fall 2018–Spring 2021.
- *Joseph E. Kist Graduate Studies Fund* from Department of Mathematical Sciences of New Mexico State University, Spring 2020–Spring 2021.
- *GNSAGA travel grant* from the Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni of INdAM to attend the summer school of TACL 2024.
- *College of A&S Graduate Student Travel Grant* from New Mexico State University to attend TACL 2019.
- *SYSMICS travel grant* from the University of Amsterdam to attend SYSMICS 2019.
- *ASL student travel grants* from the Association for Symbolic Logic to attend TACL 2017 and AiML 2018.

## SUMMER SCHOOLS

- *TACL 2024 Summer School*, Barcelona, Spain, 25-28 June 2024.
- *TACL 2019 Summer School*, Île de Porquerolles, France, 10-15 June 2019.
- *SYSMICS Summer School*, Les Diablerets, Switzerland, 22-26 August 2018.
- *TACL 2017 Summer School*, Olomouc, Czech Republic, 20-24 June 2017.
- *Scuola Estiva di Logica*, Gargnano, Italy, 21-27 August 2016.
- *Scuola Estiva di Logica*, Gargnano, Italy, 23-29 August 2015.

## OTHER ACTIVITIES

- Member of the organizing committee of LATD 2022 and the MOSAIC kick off meeting, Paestum, Italy, September 2022.
- Member of the organizing committee of BLAST 2021, Las Cruces, USA, June 2021, online.
- Reviewer for: *Advances in Modal Logic (AiML)*, *Algebra Universalis*, *Annals of Pure and Applied Logic*, *Bulletin of the Iranian Mathematical Society*, *Communications in Algebra*, *Foundations of Software Science and Computation Structures (FoSSaCS)*, *Journal of Logic and Computation*, *Journal of Symbolic Logic*, *Logic Journal of the IGPL*, *Mathscinet*, *Mathematical Logic Quarterly*, *Soft Computing*, *Studia Logica*, *Topology and its Applications*.
- Member of AILA (Italian Association of Logic and its Applications)
- Member of GNSAGA (Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni) of INdAM (Istituto Nazionale di Alta Matematica)

December 2024

A handwritten signature in black ink, consisting of a stylized 'L' followed by a series of loops and a final horizontal stroke.