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

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)
- Italian National Scientific Habilitation (ASN) to serve as Associate Professor in Logic, History and Philosophy of Science (Logica, Storia e Filosofia della Scienza, 11/C2)
- Catalan habilitation to serve as Professor Lector issued by the Catalan University Quality Assurance Agency (AQU Catalunya)

PUBLICATIONS

PUBLISHED/ACCEPTED

1. L. Carai, M. Kurtzhals, and T. Moraschini, *Epimorphisms between finitely generated algebras*, Accepted for publication in Indagationes Mathematicae, DOI: 10.1016/j.indag.2025.04.006, 2025

2. N. Bezhanishvili, L. Carai, S. Ghilardi, and Z. Zhao, *A calculus for modal compact Hausdorff spaces*, J. Log. Comput. (2025), exae086
3. 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
4. G. Bezhanishvili and L. Carai, *Failure of the Blok-Esakia Theorem in the monadic setting*, Ann. Pure Appl. Log. **176** (2025), no. 4, 103527
5. M. Abbadini, G. Bezhanishvili, and L. Carai, *Vietoris endofunctor for closed relations and its de Vries dual*, Top. Proc. **64** (2024), 213–250
6. M. Abbadini, G. Bezhanishvili, and L. Carai, *MacNeille completions of subordination algebras*, Cah. Topol. Géom. Différ. Catég. **LXV** (2024), no. 2, 151–199
7. 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
8. G. Bezhanishvili, L. Carai, and P.J. Morandi, *A frame-theoretic perspective on Esakia duality*, Algebra Univers. **84** (2023), no. 30.
9. 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
10. 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
11. 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
12. N. Bezhanishvili, L. Carai, S. Ghilardi, and L. Landi, *Admissibility of Π_2-inference rules: interpolation, model completion, and contact algebras*, Ann. Pure Appl. Logic **174** (2023), no. 1, Paper No. 103169
13. G. Bezhanishvili, L. Carai, and P.J. Morandi, *A Point-Free Approach to Canonical Extensions of Boolean Algebras and Bounded Archimedean ℓ-Algebras*, Order **40** (2023), no. 2, 257–287
14. G. Bezhanishvili and L. Carai, *Temporal interpretation of monadic intuitionistic quantifiers*, Rev. Symb. Log. **16** (2023), no. 1, 164–187
15. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Duality for powerset coalgebras*, Log. Methods Comput. Sci. **18** (2022), no. 1
16. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Modal operators on rings of continuous functions*, J. Symb. Log. **87** (2022), no. 4, 1322–1348
17. 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
18. G. Bezhanishvili, L. Carai, and P.J. Morandi, *Free bounded archimedean ℓ-algebras*, Appl. Categ. Struct. **29** (2021), no. 5, 879–888
19. 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
20. G. Bezhanishvili and L. Carai, *Temporal interpretation of intuitionistic quantifiers*, Advances in Modal Logic, vol. 13, College Publications, 2020, pp. 95–114
21. L. Carai and S. Ghilardi, *Existentially closed Brouwerian semilattices*, J. Symb. Log. **84** (2019), no. 4, 1544–1575
22. 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

23. G. Bezhanishvili and L. Carai, *Failure of Esakia's theorem in the monadic setting*, submitted, preprint available at arXiv:2409.05607, 2024.

24. L. Carai and T. Moraschini, *On the universal theory of the free pseudocomplemented distributive lattice*, submitted, preprint available at arXiv:2409.03640, 2024.
25. L. Carai *Free algebras and coproducts in varieties of Gödel algebras*, submitted, preprint available at arXiv:2406.05480, 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 ℓ-groups and vector lattices beyond archimedeanity*
  AMS Spring Western Sectional Meeting, Algebraic Logic session, 14–15 May 2022, online.
- *Dualities for abelian ℓ-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 Π_2-Inference Rules: interpolation, model completion, and contact algebras*
  TACL 2022, Coimbra, Portugal, 20–24 June 2022.
- *Admissibility of Π_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*
  Università degli Studi di Salerno, Salerno, Italy, 23 April 2025.
- *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

- Teaching assistant for *Matematica del Discreto* by C. Camere, Fall 2024, Department of Computer Science, University of Milan.
- *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)

May 2025