

Ruiyuan Chen

Department of Mathematics
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RESEARCH INTERESTS Mathematical logic, centered around descriptive set theory and connections with dynamical systems and category theory.

Specific areas of focus include: Polish groups and groupoids, countable group actions, Borel and measurable combinatorics, countable model theory, point-free topology, categorical universal algebra, and topos theory.

EMPLOYMENT **Postdoctoral Assistant Professor**
University of Michigan, August 2022–present.

CRM–Simons Postdoctoral Fellow
McGill University, September 2021–August 2022.

J.L. Doob Research Assistant Professor
University of Illinois at Urbana–Champaign, August 2018–August 2021.

EDUCATION **Ph.D. in Mathematics**
California Institute of Technology, June 2018.
Advisor: Alexander Kechris.
Thesis: *Definability and classification of equivalence relations and logical theories*.

B.Sc. in Computer Science and Mathematics
University of British Columbia, May 2013.

GRANTS & AWARDS NSF Grant DMS-2224709, “Descriptive Set Theory and Categorical Logic”
2021–2025.

NSERC Postdoctoral Fellowship (declined)
2018–2020.

Scott Russell Johnson Prize for Excellence in a Graduate Dissertation
California Institute of Technology, 2018.

NSERC Postgraduate Scholarship (doctoral)
California Institute of Technology, 2014–2017.

NSERC Postgraduate Scholarship (masters)
California Institute of Technology, 2013–2014.

Governor-General’s Silver Medal in Science
University of British Columbia, 2013.

NSERC Undergraduate Student Research Award
University of British Columbia, summers of 2011, 2012, 2013.

- R. Chen, *Componentwise Polish groupoids and equivalence relations*
in preparation, 2025.
- R. Chen, D. Gonzalez, and M. Harrison-Trainor, *Optimal syntactic definitions of back-and-forth types*
in preparation, 2025.
- R. Chen and I. Trindade, *Hilbert spaces admit no finitary discrete imaginaries*
in preparation, 2025.
- R. Chen, A. Poulin, R. Tao, and A. Tserunyan, *Tree-like graphings, wallings, and median graphings of equivalence relations*
Forum Math. Sigma **13** (2025), 37pp.
- R. Banerjee and R. Chen, *Structurable equivalence relations and $\mathcal{L}_{\omega_1\omega}$ interpretations*
submitted, <https://arxiv.org/abs/2409.02896>, 2024, 55pp.
- R. Chen and I. Ziba, *Clones of Borel Boolean functions*
submitted, <https://arxiv.org/abs/2407.06719>, 2024, 58pp.
- R. Chen, *Structural, point-free, non-Hausdorff topological realization of Borel groupoid actions*
Forum Math. Sigma **12** (2024), 53pp.
- R. Chen, *A Gelfand duality for continuous lattices*
Theory Appl. Categ. **41** (2024), 1–20.
- R. Chen, *Étale structures and the Joyal–Tierney representation theorem in countable model theory*
submitted, <https://arxiv.org/abs/2310.11539>, 2023, 41pp.
- R. Chen, G. Terlov, and A. Tserunyan, *Nonamenable subforests of multi-ended quasi-pmp graphs*
submitted, <https://arxiv.org/abs/2211.07908>, 2023, 32pp.
- R. Chen, *A universal characterization of standard Borel spaces*
J. Symb. Logic **88** (2023), 510–539.
- R. Chen, *On sifted colimits in the presence of pullbacks*
Theory Appl. Categ. **37** (2021), 1176–1193.
- R. Chen, *Decompositions and measures on countable Borel equivalence relations*
Ergodic Theory Dynam. Systems **41** (2021), 3671–3703.
- R. Chen, *On the Pettis–Johnstone theorem for localic groups*
submitted, <https://arxiv.org/abs/2109.12721>, 2021, 12pp.
- R. Chen, *Borel and analytic sets in locales*
preprint, <https://arxiv.org/abs/2011.00437>, 2020, 121pp.
- W. Chan and R. Chen, *Bounds on continuous Scott rank*
Proc. Amer. Math. Soc. **148** (2020), 3591–3605.
- R. Chen, *Representing Polish groupoids via metric structures*
preprint, <https://arxiv.org/abs/1908.03268>, 2019, 70pp.

R. Chen, *Borel functors, interpretations, and strong conceptual completeness for $\mathcal{L}_{\omega_1\omega}$*
Trans. Amer. Math. Soc. **372** (2019), 8955–8983.

R. Chen, *Amalgamable diagram shapes*
J. Symb. Logic **84** (2019), 88–101.

R. Chen, *Notes on quasi-Polish spaces*
preprint, <https://arxiv.org/abs/1809.07440>, 2018, 21pp.

R. Chen, *Borel structurability by locally finite simplicial complexes*
Proc. Amer. Math. Soc. **146** (2018), 3085–3096.

R. Chen and A. S. Kechris, *Structurable equivalence relations*
Fund. Math. **242** (2018), 109–185.

R. P. Anstee and R. Chen, *Forbidden submatrices: some new bounds and constructions*
Electron. J. Combin. **20** (2013), 13pp.

SELECTED
INVITED
TALKS

Topology versus Borel structure for actions, equivalence relations, and groupoids
ASL North American Annual Meeting, May 2025 (upcoming).

Étale structures in countable model theory and descriptive set theory
UIC logic seminar, March 2025.

Topology versus Borel structure for actions and groupoids
Very Informal Gathering of logicians, UCLA, February 2025.

End spaces of Borel and measure-class-preserving graphs
KGRC set theory seminar, November 2024.

Structurable equivalence relations, Borel combinatorics, and countable model theory
KGRC logic colloquium, November 2024.

Structurable equivalence relations and $\mathcal{L}_{\omega_1\omega}$ interpretations
Caltech logic seminar, October 2024.

Étale bundles of countable structures and separable metric structures
SEALS Conference at the University of Florida, March 2024.

Treeing Borel quasi-trees
Joint Mathematics Meetings, San Francisco, January 2024.

Étale structures in countable model theory and descriptive set theory
IMPAN Conference on DST and Dynamics, August 2023.

Quasi-treeable equivalence relations
CIRM Workshop on Measured Group Theory, Stochastic Processes on Groups and Borel Combinatorics, May 2023.

Topology versus Borel structure for actions
Nankai logic colloquium, April 2023.

Quasi-treeable equivalence relations
CRM Workshop on Measured Group Theory, March 2023.

Topology versus Borel structure for actions

CMU logic seminar, February 2023.

Topology versus Borel structure for actions

Cornell logic seminar, October 2022.

A representation theorem for cardinal algebras

ASL North American Annual Meeting, April 2022.

Infinitary logic, Polish groupoids, and classification of structures

University of Maryland logic seminar, December 2021.

Categorical aspects of descriptive set theory (tutorial)

Dagstuhl Seminar on DST and Computable Topology, November 2021.

Some results in descriptive locale theory

ASL North American Annual Meeting, June 2021.

Categorical and descriptive perspectives on classification (keynote)

Graduate Student Conference in Logic XXII, March 2021.

Gabriel–Ulmer duality for continuous categories

UWO topology seminar, March 2021.

A universal characterization of standard Borel spaces

CMS Winter Meeting, December 2020.

Imaginary sorts and strong conceptual completeness for $\mathcal{L}_{\omega_1\omega}$

SEALS Conference at the University of Florida, March 2020.

Polish groupoids and $\mathcal{L}_{\omega_1\omega}$ -theories

Joint Mathematics Meetings, Denver, January 2020.

Stone duality for infinitary logic (plenary)

BLAST Conference at the University of Colorado Boulder, May 2019.

Structurability by simplicial complexes

SEALS Conference at the University of Florida, March 2018.

Structurable equivalence relations

Logic in Southern California Conference at UCLA, May 2016.

TEACHING

Courses taught at the University of Michigan:

- Math 403 (Intro to Discrete Math), fall 2024, fall 2023.
- Math 417 (Matrix Algebra I), winter 2025, fall 2022.
- Math 419 (Linear Spaces and Matrix Theory), winter 2024, winter 2023.
- Math 481 (Intro to Mathematical Logic), fall 2024, fall 2022.
- Math 582 (Intro to Set Theory), winter 2025, winter 2024, winter 2023.
- Math 682 (Topics in Descriptive Set Theory), fall 2023.

Courses taught at the University of Illinois at Urbana–Champaign:

- Math 347 Honors (Fundamental Mathematics), fall 2020, spring 2019.
- Math 403 (Euclidean Geometry), fall 2018.
- Math 414 (Mathematical Logic), spring 2021, spring 2020.

- Math 416 (Abstract Linear Algebra), spring 2021, fall 2019.
- Math 595 (Topics in Categorical Logic), fall 2019.

Teaching assistantships at Caltech: Linear Algebra, Model Theory, Intro to Logic, Computability Theory, Probability, Calculus, Differential Equations (2013–2018).

SERVICE

Mentoring:

- Yawen Liu (undergraduate reading), University of Michigan, winter 2025.
- Isabel Trindade (REU), University of Michigan, summer 2024.
- Rishi Banerjee (M.Sc. reading + thesis), University of Michigan, summer 2023–summer 2024.
- Ruohan Hu (REU), University of Michigan, summer 2023.
- Ilir Ziba (REU), University of Michigan, summer 2023.
- Muthana Alshaikhmubarak (M.Sc. reading course), University of Illinois, spring–summer 2020.

Organizer of UIUC, McGill, and Michigan logic seminars, including student learning seminars (2019–2024).

Expository writing (posted on webpage):

- *On the Lusin–Suslin and Lusin unicity theorems*, 2024.
- *On Gaboriau’s homological proof that treeings achieve cost*, 2022.
- *Products of Scott topologies and spatiality*, 2022.
- *On uniform ergodic decomposition*, 2019.
- course notes on *Set theory*, *Categorical logic*.

Refereeing for: NSF, Advances in Mathematics, Proceedings of the LMS, Israel Journal of Mathematics, Transactions of the AMS, Journal of Symbolic Logic, Fundamenta Mathematicae, Topology Proceedings, Mathematical Logic Quarterly, Archive for Mathematical Logic.

CITIZENSHIP

Canadian