

PERRY HART

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RESEARCH INTERESTS

Current research: formally verified numerical optimization and automated theorem proving with language models.

PhD research: homotopy type theory, machine-checked mathematics, synthetic homotopy theory, and category theory.

ACADEMIC AND RESEARCH APPOINTMENTS

Postdoctoral Fellow, Institute for Computer-Aided Reasoning in Mathematics, Carnegie Mellon Sep 2026-Present

Research appointment at an NSF Mathematical Sciences Research Institute focused on AI and formal methods for mathematics.

Initial projects: formal verification of semidefinite programming solvers in Verus; automated theorem proving in Agda with language models as part of DARPA's Exponentiating Mathematics (expMATH) program.

Research Assistant, Department of Computer Science and Engineering, University of Minnesota Jan 2022-Aug 2026

Supported by the AFOSR grant "Synthetic and Constructive Mathematics of Higher Structures in Homotopy Type Theory." Worked on synthetic homotopy theory, category theory, and mechanization in Agda and Rocq/Coq.

Research Intern, Smart Information Flow Technologies, Minneapolis

May-Sep 2024

Developed FreeBSD and Linux kernel-level software for DARPA-funded security applications and contributed to probabilistic model checking for a software verification project.

EDUCATION

University of Minnesota, Ph.D. in Computer Science

Sep 2026

Advisor: Kuen-Bang Hou (Favonia)

Thesis: *On Adjunctions, Colimits, and 2-Groups in Homotopy Type Theory*

Other Thesis Committee Members: Andrew Swan, Alexander Voronov, Gopalan Nadathur, and Eric Van Wyk

University of Pennsylvania, M.A. in Mathematics

May 2020

Thesis: *The Simplicial Model of Univalent Type Theory*

Thesis Committee: Jonathan Block and Henry Towsner

Northwestern University, B.A. in Mathematics, Philosophy, and Latin

June 2017

Triple major; Phi Beta Kappa; National Merit Scholar.

PUBLICATIONS

1. Perry Hart. "On Left Adjoints Preserving Colimits in Homotopy Type Theory." Submitted to *Logical Methods in Computer Science*. arXiv:2608.28473.

Invited extended version of the CSL 2026 paper.

2. Perry Hart and Owen Milner. "Classifying 2-Groups in Homotopy Type Theory." In *41st Annual Symposium on Logic in Computer Science (LICS 2026)*, LIPIcs 380, 55:1-55:25, 2026. doi:10.4230/LIPIcs.LICS.2026.55.

3. Perry Hart. "On Left Adjoints Preserving Colimits in HoTT." In *34th EACSL Annual Conference on Computer Science Logic (CSL 2026)*, LIPIcs 363, 20:1-20:17, 2026. doi:10.4230/LIPIcs.CSL.2026.20.

Helena Rasiowa Award for Best Student Paper

4. Perry Hart and Kuen-Bang Hou (Favonia). "Coslice Colimits in Homotopy Type Theory." In *33rd EACSL Annual Conference on Computer Science Logic (CSL 2025)*, LIPIcs 326, 46:1-46:20, 2025. doi:10.4230/LIPIcs.CSL.2025.46.

Extended technical report: arXiv:2411.15103.

INVITED TALKS

"A Mechanized Characterization of Coherent 2-Groups"

2025

Summer Topology and Its Applications Conference, Topology and Computing special session, Mobile, Alabama.

CONFERENCE AND WORKSHOP TALKS

"Classifying 2-Groups in Homotopy Type Theory"

2026

LICS 2026, Federated Logic Conference (FLoC), Lisbon, Portugal.

“On Left Adjoints Preserving Colimits in Homotopy Type Theory”	2026
CSL 2026, Paris, France.	
“A Note on Left Adjoints Preserving Colimits in HoTT”	2025
HoTT/UF Workshop, Genoa, Italy.	
“Coslice Colimits in Homotopy Type Theory”	2025
CSL 2025, Amsterdam, Netherlands.	
“Colimits in the Category of Pointed Types”	2023
Conference on Homotopy Type Theory, Pittsburgh, Pennsylvania.	
“Colimits in the Category of Pointed Types”	2023
HoTT/UF Workshop, Vienna, Austria.	

ADDITIONAL RESEARCH TALKS

“A Mechanized Characterization of Coherent 2-Groups”	2025
AFOSR MURI grant meeting, Pittsburgh, Pennsylvania.	
“Coslice Colimits in HoTT”	2024
AFOSR MURI grant meeting, Pittsburgh, Pennsylvania.	
“Type-Theoretic Brown Representability”	2023
AFOSR MURI grant meeting, Pittsburgh, Pennsylvania.	

TEACHING AND ADVISING

Independent Research Advisor, University of Minnesota	2025-2026
Advised Calvin Wojahn, a mathematics major, on homotopy type theory and Rocq/Coq formalization.	
Teaching Assistant, HoTTEST Summer School, University of Western Ontario	Summer 2022
Developed and led problem sessions for an international summer school on homotopy type theory and computer formalization of mathematical proofs.	
Teaching Assistant, University of Minnesota	2020-2021
CSCI 5106: Programming Languages.	
CSCI 2041: Advanced Programming Principles.	
Teaching Assistant, University of Pennsylvania	2019-2020
MATH 114: Multivariable Calculus.	

ACADEMIC SERVICE

Organizer, Programming Languages Seminar, University of Minnesota	2023-2024
Organized the seminar in Spring 2023, Summer 2023, Fall 2023, and Fall 2024.	

SELECTED FORMALIZATIONS AND MATHEMATICAL SOFTWARE

Classifications of 2-Groups (Agda)
github.com/PHart3/2-groups-agda - Formalization accompanying the LICS 2026 paper.

Colimits and Left Adjoints in Homotopy Type Theory (Agda)
github.com/PHart3/colimits-agda - Formalization accompanying the CSL 2025 and CSL 2026 papers.

Homological Mayer-Vietoris Sequence (Rocq/Coq)
github.com/PHart3/Coq-HoTT/tree/mv_perry - Formalization for the Coq-HoTT library.

Whitehead’s Theorem (Agda)
github.com/PHart3/Whitehead-agda - Formalization in HoTT of a central theorem in homotopy theory.

Semidefinite Programming (Rust)
github.com/PHart3/convopt-rust - Self-contained semidefinite programming solver.

Risk-Parity Portfolio Optimization (Rust)
github.com/PHart3/riskparity-rust - Self-contained portfolio computation based on cyclic coordinate descent.