Ariel Kellison, PhD

Senior Research Engineer, Code Metal, Inc.

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Current Position

Senior Research Engineer, Code Metal, Inc.
Advancing formal methods for verifying and validating large language model-assisted code translation of complex software stacks.

Education

Cornell University
PhD in Computer Science — Fall 2020 – Fall 2024
Thesis: Type-Based Approaches to Rounding Error Analysis
Advisors: David Bindel (Cornell) & Andrew W. Appel (Princeton)

University of California, Santa Cruz
BSc in Astrophysics, Honors in the Major

Work Experience

Senior Research Engineer, Code Metal, Inc.	Jul. 2025 – Present
Research Engineer, Galois, Inc.	Apr. 2025 – Jul. 2025
Postdoctoral Research Associate, Sandia National Laboratories	Dec. 2024 – Apr. 2025
Research Support Specialist I, NuPRL Research Group, Cornell University	Jul. 2018 – Jan. 2020
Research Aide IV, NuPRL Research Group, Cornell University	Jul. 2016 – Jul. 2018

Internships

Graduate Student Intern in Formal Methods, Sandia National Laboratories — June 2021 – Dec. 2024

Teaching

Instructor of Record, Cornell University CS Department

- Introduction to Computing Using Python, Summer 2021

Head Graduate Student TA, Cornell University CS Department

- Introduction to Computing Using Python, Spring 2021

Publications

Conference Papers

1. *Bean: A Language for Backward Error Analysis*.
   46th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2025.
   Ariel E. Kellison, Laura Zielinski, David Bindel, Justin Hsu.
2. *Numerical Fuzz: A Type System for Rounding Error Analysis*.
   45th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2024.
   Ariel E. Kellison, Justin Hsu.
3. *VCFloat2: Floating-point Error Analysis in Coq*.
   13th ACM SIGPLAN International Conference on Certified Programs and Proofs (CPP), 2024.
   Andrew W. Appel, **Ariel E. Kellison**.
4. *LAProof: A Library of Formal Proofs of Accuracy and Correctness for Linear Algebra Programs*.
   30th IEEE International Symposium on Computer Arithmetic (ARITH), 2023.
   Ariel E. Kellison, Andrew W. Appel, Mohit Tekriwal, David Bindel.
5. *Verified Correctness, Accuracy, and Convergence of a Stationary Iterative Linear Solver: Jacobi Method*.
   16th International Conference on Intelligent Computer Mathematics (CICM), 2023.
   Mohit Tekriwal, Andrew W. Appel, **Ariel E. Kellison**, Jean-Baptiste Jeannin, David Bindel.
6. *A Machine-Checked Direct Proof of the Steiner-Lehmus Theorem*.
   11th ACM SIGPLAN International Conference on Certified Programs and Proofs (CPP), 2022.
   Ariel E. Kellison.

Journal Articles

1. *Global Stochastic Optimization of Stellarator Coil Configurations*.
   Journal of Plasma Physics, 88(2), 2022.
   Silke Glas, Misha Padidar, **Ariel E. Kellison**, David Bindel.
2. *Implementing Euclid's Straightedge and Compass Constructions in Type Theory*.
   Annals of Mathematics and Artificial Intelligence, 85:175-192, 2019.
   Ariel E. Kellison, Mark Bickford, Robert Constable.

Refereed Workshop Papers

1. *Mechanizing Olver's Error Arithmetic*.
   1st International Workshop on Verification of Scientific Software (VSS), 2025.
   Max Fan, **Ariel E. Kellison**, Samuel D. Pollard.

2. *Verified Numerical Methods for Ordinary Differential Equations.*
   15th International Workshop on Numerical Software Verification (NSV), 2022.
   Ariel E. Kellison, Andrew W. Appel.

3. *Towards Verified Rounding Error Analysis for Stationary Iterative Methods.*
   6th IEEE/ACM International Workshop on Software Correctness for HPC Applications (Correctness), 2022.
   Ariel E. Kellison, Mohit Tekriwal, Jean-Baptiste Jeannin, Geoffrey Hulette.

Technical Reports

1. *Report on the First Tri-Lab Workshop on Formal Verification* (SAND2024-02142), 2024.
   Samuel D. Pollard, Jon M. Aytac, **Ariel E. Kellison**, Ignacio Laguna, Srinivas Nedunuri, Sabrina Reis, Matthew J. Sottile, Heidi K. Thornquist.

White Papers

1. *Real(istic) Specifications of Software* (SAND2021-14778C).
   U.S. DOE ASCR Workshop on the Science of Scientific-Software Development and Use, 2021.
   Samuel D. Pollard, **Ariel E. Kellison**, John Bender, Geoffrey C. Hulette.

2. *Formal Methods Based Certification Frameworks for Scientific Computing Applications* (SAND2021-13614C).
   U.S. DOE ASCR Workshop on Cybersecurity and Privacy for Scientific Computing Ecosystems, 2021.
   Ariel E. Kellison, Geoff C. Hulette, John Bender, Samuel D. Pollard, Heidi K. Thornquist.

Awards and Honors

MIT Rising Star in EECS 2025
Massachusetts Institute of Technology and Boston University

Frederick A. Howes Scholar Award 2025
US Department of Energy Computational Science Graduate Fellowship Committee

Best Paper Finalist 2023
IEEE International Symposium on Computer Arithmetic (ARITH)

US Department of Energy Computational Science Graduate Fellowship 2020–2024
US Department of Energy Computational Science Graduate Fellowship Committee

Talks and Presentations

Formal Methods for the Age of Approximation

- *Invited Keynote.* Rocq for Programming Languages Workshop, Jan. 2026
- *Poster Presentation.* MIT Rising Stars in EECS Workshop, Oct. 2025

Elevating Correctness in Scientific Computing: A Formal Methods Perspective

- *Frederick A. Howe's Scholar Award Talk.* DOE CSGF Annual Program Review, July 2025

Bean: A Language for Backward Error Analysis

- *Paper Presentation.* 46th ACM SIGPLAN Conference on Programming Language Design and Implementation, July 2024

Designing Type Systems for Rounding Error Analysis.

- *Invited Talk.* FPBench Community Meeting, Sept. 2024

Type-Based Approaches to Rounding Error Analysis.

- *Invited Talk.* Galois, Inc., Aug. 2024
- *Final Year Fellow Talk.* DOE CSGF Annual Program Review, July 2024
- *Invited Talk.* FPTalks 2024, July 2024

Numerical Fuzz: A Type System for Rounding Error Analysis.

- *Paper Presentation.* 45th ACM SIGPLAN Conference on Programming Language Design and Implementation, June 2024
- *Invited Talk.* Cornell Programming Languages Discussion Group, Mar. 2024
- *Invited Talk.* New Jersey Programming Languages and Systems Seminar, Nov. 2023
- *Poster Presentation.* DOE CSGF Annual Program Review, July 2023

LAProof: A Library of Formal Proofs of Accuracy and Correctness for Linear Algebra Programs.

- *Invited Talk.* Midwest Programming Languages Summit hosted by the University of Michigan, Oct. 2023
- *Paper Presentation.* 30th IEEE Conference on Computer Arithmetic, Sept. 2023

Verified Numerical Methods for Ordinary Differential Equations.

- *Invited Student Talk.* Cornell Programming Languages Retreat, Dec. 2022
- *Invited Talk.* FPBench Community Meeting, Jan. 2022
- *Paper Presentation.* 15th International Workshop on Numerical Software Verification, Aug. 2022

A Machine-Checked Direct Proof of the Steiner-Lehmus Theorem.

- *Invited Student Talk.* Cornell Programming Languages Retreat, Dec. 2021

- *Paper Presentation*. 11th ACM SIGPLAN International Conference on Certified Programs and Proofs, Dec. 2021

Service

Review Committee for PLDI	2025
External Reviewer for CAV, ICALP, and POPL	2025
Journal Article Reviewer for TACO	2025
Artifact Evaluation Committee for POPL	2024
External Reviewer for CADE	2023
External Reviewer for CSL	2022

Student Advising

SIGPLAN-M Mentor	2024 – Present
Zack Cheslock (Cornell, undergraduate in CS)	Summer 2024 – Summer 2025
Laura Zielinski (Cornell, CS PhD)	Fall 2025 – Summer 2025
Max Fan (Cornell, CS PhD)	Fall 2025 – Summer 2025
Luis Hernandez (Cornell, undergraduate in CS)	Summer 2024 – Spring 2025