Adam T. **Geller**

PhD Student in Computer Science with a Focus on Programming Languages

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*My research focuses on using **type systems** within **compilers** to perform safe optimizations. As well as type systems and compilers, I am generally interested in programming languages, and have a fair bit of background with program verification. I am also interested in Quantum computing and Quantum languages/compilers.*

Education

University of British Columbia (UBC)
Vancouver, BC, Canada

Ph.D. in Computer Science (in Progress)
2020 - Ongoing (Expected Finish 2025)

Supervisor: William J. Bowman

University of British Columbia (UBC)
Vancouver, BC, Canada

M.Sc. in Computer Science (GPA: 89.3%/100)
2018 - 2020

Thesis: *An Indexed Type System for Faster and Safer WebAssembly* (doi: 10.14288/1.0392977)

Co-Supervisors: William J. Bowman, Ivan Beschastnikh

University of Washington (UW)
Seattle, WA, United States

B.Sc. in Computer Science and Engineering (GPA: 3.63/4)
2016 - 2018

Annual Dean's List, 2017-2018; Dean's List, Fall 2017, Winter 2018, Spring 2018

Bellevue College (BC)
Bellevue, WA, United States

Asc. Arts and Science DTA (GPA: 3.98/4) With High Distinction
2014 - 2016

As part of Washington State's Running Start Program

Papers

Indexed Types for Statically Safe WebAssembly
POPL 2024

Adam T. Geller, Justin Frank, William J. Bowman
doi: 10.1145/3632922

Flux: Liquid Types for Rust
PLDI 2023

Nico Lehmann, Adam T. Geller, Niki Vazou, Ranjit Jhala
doi: 10.1145/3591283

Verifying that web pages have accessible layout
PLDI 2018

Pavel Panchekha, Adam T. Geller, Michael D. Ernst, Zachary Tatlock, and Shoaib Kamil
doi: 10.1145/3192366.3192407

Talks

POPL (More Information)
2024

I presented my work on an indexed type system for WebAssembly at POPL 2024. This talk gives an overview of the project as a whole, including the type system design, how it is used for optimizations, and the performance evaluation.

PNW PLSE
2023

I presented my in-progress work on an indexed type system for WebAssembly in a lightning talk as part of PNW PLSE 2023 (Pacific Northwest Programming Languages and Software Engineering). This was a lightning talk with a short example of using the type system in practice.

SOIL Seminar (Recording and More Information)
2020

I presented my in-progress work on an indexed type system for WebAssembly as part of the SOIL Seminar series. This talk focused on the design of the indexed type system works.

Microsoft Quantum Software and Systems Team
2020

I presented my in-progress work on an indexed type system for WebAssembly to the Microsoft Quantum Software and Systems Team. This talk focused on the design of the indexed type system works.

Technical Skills

Languages I am familiar with a wide variety of programming languages. I have development experience through various projects (from most to least) with Rust, Racket, C++, and C#.

Compilers I am knowledgeable about a wide variety of compiler optimizations and compilers design strategies through my research and experience as a teaching assistant for the compilers course at UBC. I have development experience with the following, from most experience to least: Wasmtime, the Rust compiler, LLVM.

Verification My research background has a heavy influence from program verification, and I have a lot of experience both with doing program verification, and creating program verification tools (as can be seen above in my work on VizAssert at UW, and the Flux project at Imdea.)

Research Experience

University of British Columbia
GRADUATE RESEARCH ASSISTANT

2018-Current

Vancouver, BC, Canada

Currently, I am leading a team of students looking into doing typed closure conversion in a way that permits common closure optimizations, including a more optimal representation of closures, while not requiring existential types.

My first research project was building an indexed type system for WebAssembly to improve compiler optimizations. As part of this project, **I designed the indexed type system, designed a framework for using it to perform compiler optimizations, and implemented both the type system and said optimizations.** In addition, **I proved the type safety of the type system and optimizations, and performed an evaluation** to see how much speed-up is attainable through these optimizations. This project was the basis for my Master's thesis and was later published at POPL 2024 (see the papers section above for more details)

IMDEA Software Institute
RESEARCH INTERNSHIP

Jan-May 2021

Madrid, Spain

I had a 4-month research internship at IMDEA supervised by Niki Vazou where I worked on the Flux project. **I worked on verifying Rust programs using both Prusti and Flux to perform a comparison between the two**. I also assisted with testing Flux, and developed support for a few operators in Rust. During this project, I learned about the structure of the Rust compiler.

Max Planck Institute for Software Systems
RESEARCH FELLOWSHIP

May-Aug 2019

Kaiserslautern, Germany

During my 3-month research fellowship at the MPI-SWS working with Maria Christakis, I worked on a software testing project that combined fuzz testing with dynamic symbolic execution. **I implemented an experimental tool on top of Klee, which is written in C++ and uses LLVM**. I also built existing systems specially to work with the tool, which I then used for preliminary experimentation.

University of Washington
UNDERGRADUATE RESEARCH

April 2017-June 2018

Seattle, United States

For five quarters during my undergrad at UW, I was one of the developers in a research group in the Programming Languages and Software Engineering group at the University of Washington working on The Cassius Project, (cassius.uwplse.org).

I helped develop formal semantics for CSS floating elements based on the CSS informal specification and used them to write tests in Z3 to ensure that the specification is met for valid inputs. **I added support for reasoning about various CSS features**, and extended the framework's treatment of text boxes by generating constraints based on font metrics. In addition to adding features to Cassius, **I also wrote a test-case minimizer** to assist in the debugging of Cassius.

Other Experience

University of British Columbia
GRADUATE TEACHING ASSISTANT

2018,2021-2023

Vancouver, BC, Canada

Two terms of CPSC 411, Intro to Compiler Construction (2021,2023)

One term of CPSC 310, Intro to Software Engineering (2020)

One term of CPSC 416, Distributed Systems (2018)

USA Fencing/Canadian Fencing Federation
FENCING REFEREE

2010-Ongoing

United States and Canada

I am a national Fencing referee (with up-to-date SafeSport clearance) with USA Fencing and the Canadian Fencing Federation. I have refereed at local, regional, and national tournaments within the US and Canada, refereed events at every level and age group. As a referee, I have learned valuable leadership skills such as communication, teamwork, making tough decisions under pressure, and maintaining control in tense situations.

I have also been a head referee at several regional tournaments within the US. As a head ref, my role is to manage and organize the referees, handle complaints, and ensure the smooth running of the tournament as a whole.