Philipp Schröer

PhD Student in Formal Verification

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I am a PhD student in the Software Modeling and Verification Group at RWTH Aachen University. I care about solid foundations for probabilistic verification and bringing theory into practice by developing Caesar, an automated verification infrastructure for reasoning about software with randomness and proving quantitative correctness properties.

Experience

Doctoral Researcher / PhD Student 2022–present

Software Modeling and Verification Group, RWTH Aachen University Aachen

- Design and implementation of *Caesar*: an open-source deductive verifier for probabilistic programs, including HeyVL, HeyLo, SMT-based verification, model-checking integration, diagnostics, and VS Code tooling.
- Teach lectures, seminars, and practical courses in probabilistic programming, model checking, concurrency theory, and software verification; prepare exercises, lead sessions, supervise students, and support course organization.
- Publish and present research on probabilistic program verification, including work at OOPSLA, CAV, ESOP, and FM.

Student Assistant 2019–2021

Software Modeling and Verification Group, RWTH Aachen University Aachen

- Contributed to research prototypes and publications on MDP model checking, latticed k-induction, and probabilistic-program verification.
- Served as CAV 2021 artifact evaluator and supported research software development in probabilistic verification.

Software Consultant 2019

CAMPUSonline, TU Graz Graz / Aachen

- Improved performance and user-interface behavior in the RWTHonline frontend.
- Developed components of the “CoCommunity” communication program.

Student Assistant 2018

LuFG i9, RWTH Aachen University Aachen

- Designed and implemented features for SWOFI, a scientific-workflow learning platform.

Education

PhD Student in Computer Science 2022–present

RWTH Aachen University, Software Modeling and Verification Group; supervisor: Joost-Pieter Katoen Aachen

M.Sc. Computer Science 2019–2022

RWTH Aachen University; thesis: *A Deductive Verifier for Probabilistic Programs* Aachen

B.Sc. Computer Science 2015–2019

RWTH Aachen University; thesis: *Understanding Abstraction of Probabilistic Programs* Aachen

Research

Caesar verifier main project

Caesar is a deductive verifier for probabilistic programs. Its core language HeyVL, based on the real-valued logic HeyLo, expresses programs, specifications, and proof rules based on weakest pre-expectation-style semantics. Caesar uses SMT-based reasoning for verification and also provides a probabilistic model-checking backend for a subset of HeyVL.

Selected Publications

2026 **Caesar: A Deductive Verifier for Probabilistic Programs. CAV 2026.** Philipp Schröer, Kevin Batz, Umut Yiğit Dural, Darion Haase, Benjamin Lucien Kaminski, Joost-Pieter Katoen, Christoph Matheja.

2026 **Error Localization, Certificates, and Hints for Probabilistic Program Verification via Slicing. ESOP 2026.** Philipp Schröer, Darion Haase, Joost-Pieter Katoen.

2025 **Symbolic Quantitative Information Flow for Probabilistic Programs. Principles of Verification: Cycling the Probabilistic Landscape.** Philipp Schröer, Francesca Randone, Raúl Pardo, Andrzej Wąsowski.

2023 **A Deductive Verification Infrastructure for Probabilistic Programs. OOPSLA 2023. Distinguished Artifact.** Philipp Schröer, Kevin Batz, Benjamin Lucien Kaminski, Joost-Pieter Katoen, Christoph Matheja.

Selected Publications (continued)

2021 **Latticed k-Induction with an Application to Probabilistic Programs. CAV 2021.** Kevin Batz, Mingshuai Chen, Benjamin Lucien Kaminski, Joost-Pieter Katoen, Christoph Matheja, Philipp Schröer.

2020 **PrIC3: Property Directed Reachability for MDPs. CAV 2020.** Kevin Batz, Sebastian Junges, Benjamin Lucien Kaminski, Joost-Pieter Katoen, Christoph Matheja, Philipp Schröer.

Teaching

Teaching assistant for lectures, seminars, and practical courses; preparing exercises, leading sessions, supervising students, and supporting course organization.

Practical Implementation of Heuristic Algorithms for Board Games (SS26, SS25); Model Checking (WS25/26, WS24/25)

Lectures Probabilistic Programming (WS25/26, SS24, WS22/23); Concurrency Theory (WS23/24); Semantics and Verification of Software (SS23)

Seminars Probabilistic Programming (WS24/25, SS23, WS22/23); Deductive Verification (WS23/24); Trends in Computer-Aided Verification (SS22)

Selected Talks

2026 Highly Incremental: A Simple Programmatic Approach for Many Objectives. **FM 2026.** Tokyo, Japan.

2026 Error Localization, Certificates, and Hints for Probabilistic Program Verification via Slicing. **ESOP 2026.** Turin, Italy.

2025 Caesar at Summer School for Formal Techniques. **SSFT 2025.** Menlo Park, CA, USA.

2024 Caesar: A Verifier for Probabilistic Programs. **Dafny workshop at POPL 2024.** London, UK.

2023 A Deductive Verification Infrastructure for Probabilistic Programs. **OOPSLA 2023.** Cascais, Portugal.

2022 A Quantitative Verification Infrastructure. **VeriProP.** Haifa, Israel.

2022 Building a Deductive Verifier for Probabilistic Programs. **Logic of Probabilistic Programming.** CIRM, Marseille, France.

Awards & Funding

2024 ERC Proof of Concept Grant, VERIPROB: funding for the MOVES group to improve Caesar and transfer the verifier toward practical use.

2022 WhatsApp Privacy Aware Program Analysis Research Award: awarded with Joost-Pieter Katoen for “A Deductive Verification Infrastructure for Probabilistic Programs”; 6 of 62 proposals selected.

Service

Artifact evaluation program committees: ECOOP 2024, OOPSLA 2024, QEST 2023, CAV 2022, POPL 2022, CAV 2021.

External review: FM 2024, TACAS 2023.

Skills

Methods Deductive verification, probabilistic programs, SMT solving, weakest pre-expectation reasoning, model checking, program analysis, quantitative logics.

Code Rust, Python, Haskell, Java, TypeScript, JavaScript, Go, HTML/CSS, Docker.

Languages German native; English professional.