

# YUSUKE MATSUSHITA

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I am a computer scientist working as a Program-Specific **Assistant Professor** at the **Hakubi Center for Advanced Research** and the **Graduate School of Informatics, Kyoto University**.

I study **software science**, especially **formal verification** of **stateful** programs (e.g., **RustHorn**, **RustHornBelt**, **Nola**, **VerusBelt**, and **Pure Borrow**). I am also curious about many other topics, including quantum computing (e.g., **RapunSL**) and algorithms (e.g., **SoftMatcha**, **SoftMatcha 2**).

## WORK

**Apr 2026 – (Mar 2028)** — **Visiting Scientist** at **MPI-SWS, Germany**. Host: **Derek Dreyer**.

**Apr 2025 – (Mar 2030)** — **Program-Specific Assistant Professor** at the **Hakubi Center for Advanced Research, Kyoto University**. Host: **Atsushi Igarashi**, the **Computer Software Group**, Graduate School of Informatics, **Kyoto University**.

**Apr 2024 – Mar 2025** — **JSPS Fellow PD**. Host: **Atsushi Igarashi**, the **Computer Software Group**, Graduate School of Informatics, **Kyoto University**.

## EDUCATION

**Apr 2021 – Mar 2024** — **Ph.D.** in the field of **Information Science and Technology**. Dept. of Computer Science, Grad School of Information Science and Technology, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

**Apr 2019 – Mar 2021** — **Master** of **Information Science and Technology**. Dept. of Computer Science, Grad School of Information Science and Technology, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

**Apr 2015 – Mar 2019** — **Bachelor of Science**. Dept. of Information Science, School of Science, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

**Apr 2009 – Mar 2015** — **Nada Junior and Senior High School**, Japan.

## PAPERS

**arXiv 2026** — Masataka Yoneda, **Yusuke Matsushita**, Go Kamoda, Kohei Suenaga, Takuya Akiba, Masaki Waga and Sho Yokoi. **SoftMatcha 2: A Fast and Soft Pattern Matcher for Trillion-Scale Corpora**. <https://softmatcha.github.io/v2/>, <https://arxiv.org/abs/2602.10908>.

**ECOOP 2026** — Yusuke Fujiwara, **Yusuke Matsushita**, Kohei Suenaga and Atsushi Igarashi. **Ownership Refinement Types for Pointer Arithmetic and Nested Arrays**.

**PLDI 2026** — **Yusuke Matsushita** and Hiromi Ishii. **Pure Borrow: Linear Haskell Meets Rust-Style Borrowing**.

**PLDI 2026** — Travis Hance, Laila Elbeheiry, **Yusuke Matsushita** and Derek Dreyer. **VerusBelt: A Semantic Foundation for Verus's Proof-Oriented Extensions to the Rust Type System**.

**POPL 2026** — **Yusuke Matsushita**<sup>\*</sup>, Kengo Hirata<sup>\*</sup>, Ryo Wakizaka and Emanuele D'Ousualdo (<sup>\*</sup>: equal contribution). **RapunSL: Untangling Quantum Computing with Separation, Linear Combination and Mixing**. <https://dl.acm.org/doi/10.1145/3776648>.

**PLDI 2025** — **Yusuke Matsushita** and Takeshi Tsukada. **Nola: Later-Free Ghost State for Verifying Termination in Iris**. <https://dl.acm.org/doi/10.1145/3729250>.

**ICLR 2025** — Hiroyuki Deguchi, Go Kamoda, **Yusuke Matsushita**, Chihiro Taguchi, Kohei Suenaga, Masaki Waga and Sho Yokoi. **SoftMatcha: A Soft and Fast Pattern Matcher for Billion-Scale Corpus Searches**. <https://softmatcha.github.io/>, <https://openreview.net/forum?id=Q6PAnqYVpo>.

**VMCAI 2024** — Takashi Nakayama, **Yusuke Matsushita**, Ken Sakayori, Ryosuke Sato and Naoki Kobayashi. **Borrowable Fractional Ownership Types for Verification**. [https://doi.org/10.1007/978-3-031-50521-8\\_11](https://doi.org/10.1007/978-3-031-50521-8_11).

**PLDI 2022** — **Yusuke Matsushita**, Xavier Denis, Jacques-Henri Jourdan and Derek Dreyer. **RustHornBelt: A Semantic Foundation for Functional Verification of Rust Programs with Unsafe Code. Distinguished Paper Award**. <https://dl.acm.org/doi/10.1145/3519939.3523704>.

**TOPLAS 2021** — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**. <https://dl.acm.org/doi/10.1145/3462205>.

**ESOP 2020** — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs. Selected for the Special Issue of TOPLAS**. [https://link.springer.com/chapter/10.1007/978-3-030-44914-8\\_18](https://link.springer.com/chapter/10.1007/978-3-030-44914-8_18).

## THESES

**Ph.D. Dissertation, 2024** — **Yusuke Matsushita**. **Non-Step-Indexed Separation Logic with Invariants and Rust-Style Borrows**. University of Tokyo, 2024. Precursor to **Nola**. <https://shiatsumat.github.io/papers/phd-thesis.pdf>, <https://shiatsumat.github.io/talks/phd-thesis-talk.pdf>.

**Master Thesis, 2021** — **Yusuke Matsushita**. **Extensible Functional-Correctness Verification of Rust Programs by the Technique of Prophecy**. University of Tokyo, 2021. Precursor to **RustHornBelt**. <https://shiatsumat.github.io/papers/masters-thesis.pdf>.

**Senior Thesis, 2019** — **Yusuke Matsushita**. **CHC-based Program Verification Exploiting Ownership Types**. University of Tokyo, 2019. Precursor to **RustHorn**. <https://shiatsumat.github.io/papers/senior-thesis.pdf>.

## LECTURES

**Hakubi Seminar 2025** — **Yusuke Matsushita**. **Science of Software, the Fun of Rust**. Hakubi Seminar. <https://shiatsumat.github.io/talks/2025-hakubi-seminar-talk.pdf>. [https://www.hakubi.kyoto-u.ac.jp/en/sem/sem\\_273/](https://www.hakubi.kyoto-u.ac.jp/en/sem/sem_273/).

**Lecture at Kyoto University in 2024** — **Yusuke Matsushita**. **The Fun of Rust**. For the Course of CCE, Grad School of Informatics, Kyoto University. <https://shiatsumat.github.io/talks/2024-course-talk.pdf>.

**PPL Summer School 2024, Invited Lecture** — **Yusuke Matsushita**. **The World of the Separation Logic Iris**. <http://ppl.jssst.or.jp/index.php?ss2024>.

**UTokyo Open Campus 2023** — **Yusuke Matsushita** and Takashi Nakayama. **Science of Software, Aspiring to a World Free of Bugs**. Open Campus 2023, the Faculty of Science, the University of Tokyo. <https://www.youtube.com/watch?v=DDdEtX05dZ4>.

## ARTICLES

**ISPJ 2024** — **Yusuke Matsushita**. **Non-Step-Indexed Separation Logic with Invariants and Rust-Style Borrows**. Bulletin of Ph.D. Dissertations in AY 2023 Recommended by SIGs, Information Processing Society of Japan. Aug 15, 2024. <https://note.com/ipsj/n/nc0ae275045eb>.

**UTokyo Science News 2022** — **Yusuke Matsushita**. **Breaking Ground in the World of Software**. News from Faculty of Science, the University of Tokyo, Vol. 54, No. 1, 2022. [https://dl5s7ayfvssw3.cloudfront.net/WEB\\_info/p/pub/8311/54-1.pdf#page=7](https://dl5s7ayfvssw3.cloudfront.net/WEB_info/p/pub/8311/54-1.pdf#page=7).

## TALKS

**PLDI 2025** — **Yusuke Matsushita** and Takeshi Tsukada. **Nola: Later-Free Ghost State for Verifying Termination in Iris**. [https://www.youtube.com/watch?v=D7wD5tty\\_FY](https://www.youtube.com/watch?v=D7wD5tty_FY).

**TPSA 2025 & PPlanQC 2025** — **Yusuke Matsushita** (Presenter at TPSA 2025), Kengo Hirata and Ryo Wakizaka (Presenter at PPlanQC 2025). **Concurrent Quantum Separation Logic for Fine-Grained Parallelism**. Extended abstracts: <https://shiatsumat.github.io/papers/tpsa2025-cqsl.pdf>, <https://shiatsumat.github.io/papers/planqc2025-cqsl.pdf>.

**PRO-2024-1, Invited Talk** — **Yusuke Matsushita**. **New Perspectives on Program Verification and Testing Spreading from Rust**. <https://shiatsumat.github.io/talks/pro-2024-1-invited-talk.pdf>.

**PLDI 2022** — **Yusuke Matsushita**, Xavier Denis (Co-presenter), Jacques-Henri Jourdan and Derek Dreyer. **RustHornBelt: A Semantic Foundation for Functional Verification of Rust Programs with Unsafe Code**. <https://www.youtube.com/watch?v=pOg4dEhr5hI>.

**ESOP 2020** — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**. <https://www.morressier.com/article/rusthorn-chcbased-verification-rust-programs/604907f41a80aac83ca25d55>.

**JSSST 2020, Invited Talk** — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**. [https://www.youtube.com/watch?v=Ah\\_Bds6I\\_YI](https://www.youtube.com/watch?v=Ah_Bds6I_YI).

**PPL 2020** — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**.

## POSTERS

**PPL 2025** — **Yusuke Matsushita**, Yudai Tanabe, Taro Sekiyama and Atsushi Igarashi. **Pure Realization of Rust-Style Borrows in Linear Haskell**. **Best Poster Award**.

**PPL 2019** — **Yusuke Matsushita**, Naoki Kobayashi and Takeshi Tsukada. **CHC-based Program Verification Exploiting Ownership Types**.

## GRANTS & FELLOWSHIPS

**Apr 2026 – (Mar 2028)** — **JSPS Overseas Research Fellowship**. Exploring New Foundations for Software Development in the Age of Rust. Host: **Derek Dreyer, MPI-SWS, Germany**.

**Apr 2025 – (Mar 2030)** — **The Hakubi Project, Kyoto University**. Exploring a New Age of Software Development Springing from Rust.

**Apr 2024 – Mar 2027** — **JSPS Research Fellowship for Young Scientists PD**. Foundations and Applications for Robust and High-Performance System Software.

**Apr 2021 – Mar 2024** — **JSPS Research Fellowship for Young Scientists DC1**. Theory and Application for Robust and High-Performance Systems Programming Languages.

## SERVICE

**July 2026 – Nov 2026** — **Program Committee member** of **POPL 2027**.

**Jan 2026 – Mar 2026** — **Program Committee member** of **PPL 2026**.

**Nov 2025 – Apr 2026** — **Review Committee member** of **PLDI 2026**.

**Feb 2025 – Mar 2025** — **External reviewer** of **PLDI 2025**.

**Jan 2025 – Mar 2025** — **Program Committee member** of **PPL 2025**.

## TEACHING

**Aug 2025** — Lecturer of L1 **Rust Verifier Development Seminar** at **IPA Security Camp 2025** <https://www.ipa.go.jp/jinzai/security-camp/2025/camp/zenkoku/program/l.html#l1>.

**Aug 2024** — Lecturer of S15 **Rust Program Verification Seminar** at **IPA Security Camp 2024** <https://www.ipa.go.jp/jinzai/security-camp/2024/camp/zenkoku/program/kaihatsu.html#s15>.

**Apr 2022 – Aug 2022, Apr 2019 – Aug 2019** — Teaching assistant of "**Functional and Logic Programming Experiments**" at Dept. of Information Science, School of Science, **University of Tokyo**.

**Sept 2019 – Feb 2020** — Teaching assistant of "**Processor and Compiler Experiments**" at Dept. of Information Science, School of Science, **University of Tokyo**.

**Mar 2018** — Lecturer of "**Purely Functional Data Structures**" at the **Japanese Olympiad in Informatics 2017 Spring Training Camp**.

**Aug 2017** — Tutor on "**Purely Functional Data Structures**" by Chris Okasaki at the **Japanese Olympiad in Informatics 2017 Summer Seminar**.

## HONORS & AWARDS

**2025** — **Hakubi Researcher** at the **Hakubi Center for Advanced Research, Kyoto University**.

**2025** — **Best Poster Award** at **PPL 2025**.

**2024** — **Invited Lecture** at **PPL Summer School 2024**.

**2022** — **Distinguished Paper Award** at **PLDI 2022**.

**2020** — Selected for **TOPLAS ESOP 2020 Special Issue**.

**2018** — **Sub-leader** of Japan's special team for the **International Olympiad in Informatics 2018**.

**2013 & 2012** — **Finalist** in the **Japanese Olympiad in Informatics 2013 & 2012**.

**2013** — **Quarter-finalist** in the **National High School English Debate Tournament 2013**.

## EXPERIENCES

**Nov 2022 – Feb 2023** — **Software Engineer Intern** at **ChromeOS Velocity Team, Google Tokyo**.

**Sept 2020 – June 2021** — **Visiting Scholar** at the **RustBelt** team, led by **Derek Dreyer**, at **Max Planck Institute for Software Systems**.

**Aug 2019 – Jan 2020** — **Software Engineer Intern** at **CADDi**, a startup in Japan that builds a digital marketplace for manufacturing. Interview article: [https://www.wantedly.com/companies/caddi/post\\_articles/200577](https://www.wantedly.com/companies/caddi/post_articles/200577).

**Mar 2017 – Mar 2019** — **Research Intern** at **Morishita Lab** (human genome informatics), in Dept. of Computational Biology and Medical Sciences, Grad School of Frontier Science, University of Tokyo.

**Dec 2015 – Dec 2016** — **President** of **UTokyo Piano Society**, a piano club of ~200 members.

## SKILLS

**Languages** — **Japanese** (Native), **English** (CEFR B2/C1).

**Programming** — **Rust, Rocq, C/C++, OCaml, Haskell, TypeScript**.