Alexander **Strack**

Researcher · HPC Performance Engineer · Distributed Runtimes and GPU Computing

University of Stuttgart
Institute of Parallel and Distributed Systems
Scientific Computing
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Profile

Performance engineer and Ph.D. candidate at the University of Stuttgart, bridging the gap between high-performance computing and real-world applications in scientific computing and artificial intelligence. Research focuses on asynchronous many-task systems, performance portability, and parallel programming models for heterogeneous hardware, from GPUs and ARM CPUs to emerging RISC-V platforms. This work has so far resulted in 16 peer-reviewed publications (9 as first author), 13 supervised student theses and projects, and invited talks at RISC-V International, LSU, and UT Austin.

Professional Experience

Visiting Researcher *09/2026–03/2027*
Louisiana State University *Baton Rouge, U.S.*
Division of Computer Science & Engineering

Researcher *12/2022–present*
University of Stuttgart *Stuttgart, Germany*
Scientific Computing

Internships

Ph.D. Research Intern *06/2024–08/2024*
Los Alamos National Laboratory *Los Alamos, U.S.*
Co-design Summer School

Graduate Thesis Intern *11/2021–05/2022*
Robert Bosch GmbH *Renningen, Germany*
Powertrain Systems

Education

Ph.D. Computer Science *2022–expected 05/2027*
University of Stuttgart, Germany
Thesis: Scalable Asynchronous Tasking for Machine Learning and Scientific Computing on Emerging Architectures
Advisor: Prof. Dr. Dirk Pflüger (University of Stuttgart)

M.Sc. Simulation Technology *2020–2022*
University of Stuttgart, Germany, 2-year program, 120 ECTS *1.2 (U.S. GPA 3.95)*
Thesis: Active Learning Optimization for Dynamical System Identification with Gaussian Processes

B.Sc. Simulation Technology *2017–2020*
University of Stuttgart, Germany, 3-year program, 189 ECTS *2.2 (U.S. GPA 3.43)*
Thesis: Dynamic Workload Balancing for Heterogeneous Systems

Technical Skills

Parallelization	HPX (asynchronous many-task), MPI, OpenMP, CUDA, SYCL, Kokkos
Profiling	Intel VTune, NVIDIA Nsight
Architectures	x86-64, ARM, RISC-V, NVIDIA/AMD/Intel GPUs
Programming & Tools	C/C++, Python (TensorFlow, PyTorch); Git, Slurm, Linux; Claude Code, Codex

Publications

Conferences & Workshops

[C14] Linus Bantel, Moritz Strack, **Alexander Strack**, and Dirk Pflüger. "From Prompts to Performance: Evaluating LLMs for Task-Based Parallel Code Generation". In: *Asynchronous Many-Task Systems and Applications*. Ed. by Patrick Diehl, Markus Rampp, Erwin Laure, and Martin Schulz. Cham: Springer Nature Switzerland, 2026, pp. 15–26. ISBN: 978-3-032-27676-6. DOI: 10.1007/978-3-032-27676-6_2.

[C13] Maksim Helmann, **Alexander Strack**, and Dirk Pflüger. "GPRat: Gaussian Process Regression with Asynchronous Tasks". In: *Asynchronous Many-Task Systems and Applications*. Ed. by Patrick Diehl, Qinglei Cao, Thomas Herault, and George Bosilca. Cham: Springer Nature Switzerland, 2026, pp. 83–94. ISBN: 978-3-031-97196-9. DOI: 10.1007/978-3-031-97196-9_7.

[C12] Henrik Möllmann, Dirk Pflüger, and **Alexander Strack**. "GPU-Resident Gaussian Process Regression Leveraging Asynchronous Tasks with HPX". In: *Asynchronous Many-Task Systems and Applications*. Ed. by Patrick Diehl, Markus Rampp, Erwin Laure, and Martin Schulz. Cham: Springer Nature Switzerland, 2026, pp. 27–39. ISBN: 978-3-032-27676-6. DOI: 10.1007/978-3-032-27676-6_3.

[C11] **Alexander Strack**, Patrick Diehl, and Dirk Pflüger. "Is RISC-V Ready for Machine Learning? Portable Gaussian Processes Using Asynchronous Tasks". In: *ISC Workshops (RISC-V), to appear*. 2026. DOI: 10.48550/arXiv.2604.00736. arXiv: 2604.00736 [cs.DC]. URL: https://arxiv.org/abs/2604.00736.

[C10] **Alexander Strack**, Marcel Graf, Alexander Van Craen, and Dirk Pflüger. "Performance-Portable Exact Gaussian Process Regression in Python via SYCL and oneMath". In: *2026 Workshop on Accelerator Programming and Directives (WACCPD), held in conjunction with SC26*. To appear. Chicago, IL, USA, Nov. 2026.

[C9] **Alexander Strack**, Marcel Graf, Alexander Van Craen, and Dirk Pflüger. "PortLBM: A Portable Lattice Boltzmann Tool Leveraging SYCL on AMD, NVIDIA, and Intel GPUs". In: *Euro-Par Workshops (HeteroPar), to appear*. 2026. DOI: 10.48550/arXiv.2607.20650. arXiv: 2607.20650 [cs.DC]. URL: https://arxiv.org/abs/2607.20650.

[C8] **Alexander Strack**, Hartmut Kaiser, and Dirk Pflüger. "Radiation Hydrodynamics at Scale: Comparing MPI and Asynchronous Many-Task Runtimes with FleCSI". In: *IPDPS Workshops (APDCM), to appear*. 2026. DOI: 10.48550/arXiv.2603.05366. arXiv: 2603.05366 [cs.DC]. URL: https://arxiv.org/abs/2603.05366.

[C7] **Alexander Strack**, Christopher Taylor, and Dirk Pflüger. "Parallel FFTW on RISC-V: A Comparative Study Including OpenMP, MPI, and HPX". In: *High Performance Computing*. Ed. by Sarah Neuwirth, Arnab Kumar Paul, Tobias Weinzierl, and Erin Claire Carson. Cham: Springer Nature Switzerland, 2026, pp. 586–597. ISBN: 978-3-032-07612-0. DOI: 10.1007/978-3-032-07612-0_45.

[C6] **Alexander Strack**, Alexander Van Craen, and Dirk Pflüger. "From Fork-Join to Asynchronous Tasks: Parallelizing Tiled Cholesky Decomposition with OpenMP and HPX". In: *PPAM Workshops (AMTE), to appear*. 2026. DOI: 10.48550/arXiv.2606.11937. arXiv: 2606.11937 [cs.DC]. URL: https://arxiv.org/abs/2606.11937.

[C5] Tim Thüring, Malte Horst, **Alexander Strack**, Alexander Van Craen, and Dirk Pflüger. "From GPU-Accelerated Systems to Modern NVIDIA and AMD Superchips: Analyzing Energy and Power of a Heterogeneous SYCL Application". In: *Sustainable Supercomputing, held in conjunction with SC26*. To appear. Chicago, IL, USA, Nov. 2026.

[C4] Tim Thüring, **Alexander Strack**, and Dirk Pflüger. "Comparing the Performance of Heterogeneous Conjugate Gradient and Cholesky Solvers on Various Hardware Using SYCL". In: *Proceedings of the International Workshop on OpenCL and SYCL*. IWOCL '26. New York, NY, USA: Association for Computing Machinery, 2026. ISBN: 9798400724992. DOI: 10.1145/3811257.3811260.

[C3] **Alexander Strack** and Dirk Pflüger. “A HPX Communication Benchmark: Distributed FFT Using Collectives”. In: *Euro-Par 2024: Parallel Processing Workshops*. Ed. by Silvina Caino-Lores, Demetris Zeinalipour, Thaleia Dimitra Doudali, David E. Singh, Gracia Ester Martín Garzón, Leonel Sousa, Diego Andrade, Tommaso Cucinotta, Donato D’Ambrosio, Patrick Diehl, Manuel F. Dolz, Admela Jukan, Raffaele Montella, Matteo Nardelli, Marta Garcia-Gasulla, and Sarah Neuwirth. Cham: Springer Nature Switzerland, 2025, pp. 271–274. ISBN: 978-3-031-90203-1. DOI: 10.1007/978-3-031-90203-1_25.

[C2] **Alexander Strack**, Christopher Taylor, Patrick Diehl, and Dirk Pflüger. “Experiences Porting Shared and Distributed Applications to Asynchronous Tasks: A Multidimensional FFT Case-Study”. In: *Asynchronous Many-Task Systems and Applications*. Ed. by Patrick Diehl, Joseph Schuchart, Pedro Valero-Lara, and George Bosilca. Cham: Springer Nature Switzerland, 2024, pp. 111–122. ISBN: 978-3-031-61763-8. DOI: 10.1007/978-3-031-61763-8_11.

[C1] **Alexander Strack** and Dirk Pflüger. “Scalability of Gaussian Processes Using Asynchronous Tasks: A Comparison Between HPX and PETSc”. In: *Asynchronous Many-Task Systems and Applications*. Ed. by Patrick Diehl, Peter Thoman, Hartmut Kaiser, and Laxmikant Kale. Cham: Springer Nature Switzerland, 2023, pp. 52–64. ISBN: 978-3-031-32316-4. DOI: 10.1007/978-3-031-32316-4_5.

Journals

[J2] Joseph Schuchart, Patrick Diehl, Michael Bauer, Aurelien Bouteiller, Gregor Daiss, Engin Kayraklioglu, Shreyas Khandekar, Thomas Herault, John Holmen, Ritvik Rao, **Alexander Strack**, Elliott Slaughter, Jennifer Spinti, Jeremy Thornock, Alex Aiken, Olivier Aumage, Martin Berzins, George Bosilca, Bradford Chamberlain, Hartmut Kaiser, and Laxmikant Kale. “A Survey of Distributed Asynchronous Many-Task Models and Their Applications”. In: *ACM Comput. Surv.* 58.16 (Aug. 2026), pp. 1–38. DOI: 10.1145/3840389.

[J1] Julien Loiseau, Hyun Lim, Andrés Yagüe López, Mammadbaghir Baghirzade, Shihab Shahriar Khan, Yoonsoo Kim, Sudarshan Neopane, **Alexander Strack**, Farhana Taiyebah, and Ben Bergen. “HARD: A performance portable radiation hydrodynamics code based on FleCSI framework”. In: *SoftwareX* 32 (2025), p. 102441. ISSN: 2352-7110. DOI: 10.1016/j.softx.2025.102441. URL: https://www.sciencedirect.com/science/article/pii/S2352711025004078.

Posters

[P2] **Alexander Strack**, Mammadbaghir Baghirzade, Shihab Shahriar Khan, Yoonsoo Kim, Sudarshan Neopane, Farhana Taiyebah, Julien Loiseau, and Hyun Lim. “Radiation Hydrodynamics at Scale with FleCSI-HARD”. In: *Salishan Conference on High Speed Computing*. 2025.

[P1] Mammadbaghir Baghirzade, Shihab Shahriar Khan, Yoonsoo Kim, Sudarshan Neopane, **Alexander Strack**, Farhana Taiyebah, Julien Loiseau, and Hyun Lim. “Computational Radiation Hydrodynamics with FleCSI”. In: *The International Conference for High Performance Computing, Networking, Storage, and Analysis*. 2024.

Source Code & Artifacts

[A5] *Cholesky-Bench: GitHub Code Repository*. URL: https://github.com/constracktor/Cholesky-Bench.

[A4] *GPRat: GitHub Code Repository*. URL: https://github.com/SC-SGS/GPRat.

[A3] *HARD: GitHub Code Repository*. URL: https://github.com/lanl/HARD.

[A2] *HPX-FFT: GitHub Code Repository*. URL: https://github.com/constracktor/HPX-FFT.

[A1] *PortLBM: GitHub Code Repository*. URL: https://github.com/SC-SGS/PortLBM.

Talks

Invited Talks

[I4] *Evaluating Asynchronous Machine Learning and Scientific Computing Applications on RISC-V, ARM, and x86*. Invited Talk. At RISC-V International (RISC-V Technical Session). Online. July 2026.

[I3] *Task-Based Parallelization for Machine Learning and Scientific Computing Applications*. Invited Talk. At Fulda University of Applied Sciences. Fulda (Germany). July 2026.

[I2] *Asynchronous Tasks in Scientific Computing*. Invited Talk. At Oden Institute. UT Austin (U.S.). Feb. 2025.

[I1] *Leveraging HPX for FFT and Cholesky Decomposition*. Invited Talk. At Division of Computer Science & Engineering. Louisiana State University (U.S.). Feb. 2024.

Peer-Reviewed Presentations

[T11] *From Fork-Join to Asynchronous Tasks: Parallelizing Tiled Cholesky Decomposition with OpenMP and HPX*. Paper Presentation. At International Conference on Parallel Processing and Applied Mathematics Workshops (AMTE). Poznań (Poland). Sept. 2026.

[T10] *PortLBM: A Portable Lattice Boltzmann Tool Leveraging SYCL on AMD, NVIDIA, and Intel GPUs*. Paper Presentation. At International European Conference on Parallel and Distributed Computing Workshops (HeteroPar). Pisa (Italy). Aug. 2026.

[T9] *Is RISC-V Ready for Machine Learning? Portable Gaussian Processes Using Asynchronous Tasks*. Paper Presentation. At ISC High Performance Conference Workshops (RISC-V). Hamburg (Germany). June 2026.

[T8] *Radiation Hydrodynamics at Scale: Comparing MPI and Asynchronous Many-Task Runtimes with FleCSI*. Paper Presentation. At International Parallel & Distributed Processing Symposium Workshops (APDCM). New Orleans (U.S.). May 2026.

[T7] *GPU-Resident Gaussian Process Regression Leveraging Asynchronous Tasks with HPX*. Paper Presentation. At Workshop on Asynchronous Many-Task Systems and Applications (WAMTA). Munich (Germany). Feb. 2026.

[T6] *Hierarchical Collective Operations for HPX*. Presentation. At International Parallel Tools Workshop (IPTW). Stuttgart (Germany). Nov. 2025.

[T5] *Parallel FFTW on RISC-V: A Comparative Study including OpenMP, MPI, and HPX*. Paper Presentation. At ISC High Performance Conference Workshops (RISC-V). Hamburg (Germany). June 2025.

[T4] *Radiation Hydrodynamics at Scale with FleCSI-HARD*. Poster Presentation. At Salishan Conference on High Speed Computing. Gleneden Beach (U.S.). Apr. 2025.

[T3] *GPRat: Gaussian Process Regression with Asynchronous Tasks*. Paper Presentation. At Workshop on Asynchronous Many-Task Systems and Applications (WAMTA). St. Louis (U.S.). Feb. 2025.

[T2] *A HPX Communication Benchmark: Distributed FFT using Collectives*. Poster Presentation. At International European Conference on Parallel and Distributed Computing (Euro-Par). Madrid (Spain). Aug. 2024.

[T1] *Experiences Porting Distributed Applications to Asynchronous Tasks: A Multidimensional FFT Case-study*. Paper Presentation. At Workshop on Asynchronous Many-Task Systems and Applications (WAMTA). Knoxville (U.S.). Feb. 2024.

Supervising

M.Sc. Thesis: *Heterogeneous Mixed-Precision Solvers for Linear Systems using SYCL* — *Summer Semester 2026*

- *Co-supervisor.* Duties include preparing the topic and co-supervising the technical part. — *30 ECTS*

M.Sc. Thesis: *Extending GPRat to Support Distributed Computing* — *Winter Semester 2025/2026*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. — *30 ECTS*

M.Sc. Thesis: *Heterogeneous Solvers for Linear Systems with Symmetric Positive-Definite Matrices Using SYCL* — *Winter Semester 2025/2026*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. — *30 ECTS*

M.Sc. Research Project: ***Portability for GPRat: Combining HPX with SYCL and oneMath*** *Winter Semester 2025/2026*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the report. *9 ECTS*

M.Sc. Research Project: ***Extension of HPX-FFT to 3D*** *Winter Semester 2025/2026*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the report. *9 ECTS*

M.Sc. Research Project: ***Control of an Inverted Pendulum using Gaussian Processes*** *Winter Semester 2025/2026*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the report. *9 ECTS*

B.Sc. Thesis: ***Hierarchical Collectives for HPX*** *Summer Semester 2025*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. *12 ECTS*

B.Sc. Thesis: ***Real-time visualized and GPU-accelerated Lattice Boltzmann simulations*** *Summer Semester 2025*

- *Supervisor.* Duties include co-supervising the technical work, and guiding the development of the manuscript. *12 ECTS*

B.Sc. Thesis: ***Accelerator Support for GPRat: A Task-based Gaussian Process Library in Python*** *Winter Semester 2024/2025*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. *12 ECTS*

M.Sc. Thesis: ***Distributed Task-based Conjugated Gradients: A Comparison between HPX and MPI+X*** *Summer Semester 2024*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. *30 ECTS*

M.Sc. Thesis: ***GPPPy: Leveraging HPX and BLAS to accelerate Gaussian Processes*** *Summer Semester 2024*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the manuscript. *30 ECTS*

M.Sc. Research Project: ***Task-based Solar System Simulations using Senders/Receivers*** *Summer Semester 2024*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the report. *9 ECTS*

B.Sc. Research Project: ***Task-based Lattice-Boltzmann with HPX*** *Summer Semester 2024*

- *Supervisor.* Duties include preparing the topic, supervising the technical work, and guiding the development of the report. *9 ECTS*

Teaching

M.Sc. Seminar: ***Strategies of Modern High-Performance Computing*** *Summer Semester 2026*

- *Co-organizer and co-supervisor.* Seminar topics include core concepts in optimization, tools for shared-memory and distributed-memory parallelization, and programming for emerging hardware platforms. *3 ECTS*

M.Sc. Lab Course: ***Solar System Simulation*** *Summer Semester 2026*

- *Co-organizer.* The goal of the course is to efficiently parallelize an N-body simulation of our solar system, implementing the Barnes-Hut algorithm with MPI+OpenMP. *9 ECTS*

B.Sc. Programming Project: *Galaxy Crash* *Summer Semester 2026*

- *Co-organizer.* The goal of this project is to implement and visualize the crash of the Milky Way and the Andromeda Galaxy with C++. Starting with a naive approach, the Barnes-Hut algorithm is used to improve scalability.

9 ECTS

B.Sc. Seminar: *Concepts of Modern C++* *Winter Semester 2025/2026*

- *Organizer and supervisor.* Seminar topics include fundamental concepts of the C++ programming language as well as advanced features closely aligned with recent and upcoming C++ standard developments.

3 ECTS

M.Sc. Lab Course: *Solar System Simulation* *Winter Semester 2025/2026*

- *Co-organizer.* The goal of the course is to efficiently parallelize an N-body simulation of our solar system, implementing the Barnes-Hut algorithm with MPI+OpenMP.

9 ECTS

B.Sc. Programming Project: *Galaxy Crash* *Winter Semester 2025/2026*

- *Co-organizer.* The goal of this project is to implement and visualize the crash of the Milky Way and the Andromeda Galaxy with C++. Starting with a naive approach, the Barnes-Hut algorithm is used to improve scalability.

6 ECTS

M.Sc. Seminar: *Strategies of Modern High-Performance Computing* *Summer Semester 2025*

- *Organizer and co-supervisor.* Seminar topics include core concepts in optimization, tools for shared-memory and distributed-memory parallelization, and programming for emerging hardware platforms.

3 ECTS

M.Sc. Lab Course: *Solar System Simulation* *Summer Semester 2025*

- *Co-organizer.* The goal of the course is to efficiently parallelize an N-body simulation of our solar system, implementing the Barnes-Hut algorithm with MPI+OpenMP.

9 ECTS

B.Sc. Programming Project: *Galaxy Crash* *Summer Semester 2025*

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B.Sc. Seminar: *Concepts of Modern C++* *Winter Semester 2024/2025*

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9 ECTS

B.Sc. Programming Project: *Galaxy Crash* *Winter Semester 2024/2025*

- *Co-organizer.* The goal of this project is to implement and visualize the crash of the Milky Way and the Andromeda Galaxy with C++. Starting with a naive approach, the Barnes-Hut algorithm is used to improve performance.

6 ECTS

M.Sc. Seminar: *Strategies of Modern High-Performance Computing* *Summer Semester 2024*

- *Organizer and co-supervisor.* Seminar topics include core concepts in optimization, tools for shared-memory and distributed-memory parallelization, and programming for emerging hardware platforms.

3 ECTS

B.Sc. Seminar: *Concepts of Modern C++* *Winter Semester 2023/2024*

- *Organizer and co-supervisor.* Seminar topics include fundamental concepts of the C++ programming language as well as advanced features closely aligned with recent and upcoming C++ standard developments. *3 ECTS*

M.Sc. Seminar: *Advanced Parallel Computing* *Summer Semester 2023*

- *Co-organizer and co-supervisor.* Seminar topics include core concepts in code optimization and parallel computing for shared-memory and distributed-memory environments. *3 ECTS*

Service to Profession

Student Volunteer *2026*

- The International Conference for High Performance Computing, Networking, Storage, and Analysis, SC26, Chicago (U.S.)

Student Volunteer *2025*

- The International Conference for High Performance Computing, Networking, Storage, and Analysis, SC25, St. Louis (U.S.)

Mentor *2026*

- Google Summer of Code, Online

Invited Reviewer *2026*

- International Workshop on RISC-V for HPC (RISCV-HPC), SC26, Chicago (U.S.)

Awards & Grants

2026	**Travel Grant**, Student Volunteer: The International Conference for High Performance Computing, Networking, Storage, and Analysis	*Chicago, U.S.*
2025	**Travel Grant**, Student Volunteer: The International Conference for High Performance Computing, Networking, Storage, and Analysis	*St. Louis, U.S.*

Further Qualifications

Academic Writing in English *2024*

University of Stuttgart, Germany

C++ Software Design (Advanced) *2023*

HLRS, Germany

Languages

- German: Native
- English: Fluent (C1)
- French: Basic (A2)

Professional Memberships

ACM SIGHPC Student Member *2024–present*