Dr. Michel Steuwer

Chair of Compilers and
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Professional Experience

since July 2023 — **Professor, Chair of Compilers and Programming Languages**, Technische Universität Berlin, Germany.

2020–2023 — **Lecturer / Senior Lecturer**, University of Edinburgh, UK.

2017–2020 — **Lecturer**, University of Glasgow, UK.

2014–2017 — **Postdoctoral Research Associate**, University of Edinburg, UK.

2010–2014 — **Research Associate**, University of Münster, Germany.

University Education

2010–2015 — **PhD degree in computer science**, University of Münster, Germany.
Supervisor: Prof. Sergei Gorlatch

2005–2010 — **Diploma degree in computer science with a minor in mathermatics**, (equivalent to combined MSc and BSc) University of Münster, Germany.

Honours and Achievements

- Our **ICFP 2020** paper has been selected as a **ACM SIGPLAN Research Highlight** in September 2021 and has been published as a **Communications of the ACM Research Highlight** in March 2023.
- **Best Paper Award Winner** at **CGO 2018** and **SLE 2022**.
- **HiPEAC Paper Award Winner** for **ASPLOS 2018** and **ICFP 2020** papers.
- **Most cited papers** at **ICFP 2015** and **CGO 2017**.
- **PhD thesis** honoured with the highest possible grade **Summa cum laude**. **Nominated** as one of 34 for the **prize for the best dissertation** of 2015 in Informatics from Germany, Austria, or Switzerland.

Research Projects and Grants

- Co-Investigator on the **EPSRC funded project** *Efficient Cross-Domain DSL Development for Exascale (EP/W007940/1)*, £1M, August 2021 - August 2024. Together with Tobias Grosser (PI), Nick Brown, Amy Krause at Edinburgh and Gerard Gorman and Paul Kelly at Imperial.

- **Google Faculty Award 2019**, *A functional Intermediate Representation for MLIR*, $50K, sponsored by Jacques Pienaar and Albert Cohen.
- Collaborator on a project funded as part of the **Software Defined Hardware (SDH) programme by DARPA**. Together with Michael O'Boyle and Murray Cole at Edinburgh and collaborators at the University of Michigan, Arizoina State in the US, and McGill in Canada.

Research Community Activities

Program Commitees, Artifact Evaluation Comitees & Reviewing

- **Program Committee Chair** of CGO 2024.
- **Program Committee Member** of Haskell 2023, Euro-Par 2023, CGO 2022, 2020, 2019, CC 2020, GPCE 2020, 2019, LCTES 2019, 2018, ICPP 2020, FHPNC 2021, 2020, HLPP 2020, 2019, 2018, 2017, 2016, DHPC++ Worskop 2019, 2018, and, IEEE ScalCom 2016.
- **Artifact Evaluation Commitee Member** of ICFP 2017, CGO 2017, and, PACT 2016.
- **External reviewer for journals**: Communications of the ACM, ACM TODS, ACM TACO, ACM Computing Surveys, Science of Computer Programming Jounral (Elsevier), The Journal of Supercomputing (Springer), and, Software: Practice and Experience (Wiley).
- **Expernal reveiwer for conferences**: MLSys, CC, CGO, Euro-Par, EuroMPI, CCGrid, and, ParCo.
- **Reviewer for funding bodies**: UK Engineering and Physical Sciences Research Council (EPSRC), German Research Foundation (DFG), German Federal Ministry of Education and Research (BMBF), Netherlands Organisation for Scientific Research, and, Natural Sciences and Engineering Research Council Canada.

Organization Committees

- **General Chair** of PPoPP 2024.
- **Steering Committee Member** of CGO since 2021.
- **Artifact Evaluation Chair** of CGO 2021, 2020, 2019, 2018, CC 2021, 2020, and, LCTES 2019, 2018.
- **Local Organization Co-Chair** of HiPEAC Computer Systems Week April 2019, Scottish Programming Language Seminar March 2018, October 2019, and, UK Many-Core Developer Conference May 2016.
- **Web Chair** of Euro-Par 2022 and CC 2018.

Memberships in Research Networks

- Member of **ACM**, the German Informatics Society (**GI**: Gesellschaft für Informatik), the UK Manycore Research, Innovation and Opportunities Network (**MaRIONet**), the European Network on High Performance and Embedded Architecture and Compilation (**HiPEAC**) (Academic Member), the Institute for Computer Systems Architecture (**ICSA**) at the University of Edinburgh, and regular participant of the Scottish Programming Language Seminars (**SPLS**).

Local University Activities

- I was the **undergraduate year 1 organizer** coordinating the teaching of about 400 students at the School of Informatics in Edinburgh.
- I was the **research student committee convener** of the School of Computing Science at the University of Glasgow (2019-20). Overseeing the academic progression of over 100 PhD students.
- I organized various seminar series and discussion groups at Glasgow and Edinburgh, including: **Upwards**, a seminar series discussing all aspects of research life to facilitate knowledge sharing among academics and providing career advice; the **Programming Language Research Programme** at Edinburgh with a popular seminar series; the **Humble C++ Programmer Group** discussing practical programming in C++ targeted at PhD students to improve their coding skills.

Research Visits

- Hosting multiple visiting researchers from the University of Münster, Germany and the University of Zagreb, Croatia for multi-month in- person visits. Funded from 2016—2023 by EuroLab-4-HPC, HPC- Europa3 and HiPEAC.
- Visiting researcher at dividiti Ltd. in Cambridge, UK 2016 (3 month, funded by HiPEAC).
- Visiting researcher at the University of Edinburgh, Scotland, UK 2012 (3 month, funded by HPC-Europa2), 2013 (4 month, funded by HiPEAC), and 2014 (4 month).

Supervised PhD Students

Main Supervisor of Currently Active PhD Students

since 09/2020	Xueying Qin	University of Edinburgh
since 10/2019	Rongxiao Fu	University of Edinburgh

since 10/2019 Johannes Lenfers together with Sergei Gorlatch, University of Münster

since 09/2019 Martin Lücke University of Edinburgh

since 10/2018 Bastian Köpcke together with Sergei Gorlatch, University of Münster

Second Supervisor of Currently Active PhD Students

since 10/2020 Zhibo Li main supervisor Björn Franke, University of Edinburgh

since 09/2020 Celeste Hollenbeck main supervisor Michael O'Boyle, University of Edinburgh

Main Supervisor of Graduated PhD Students

2018–2022 Thomas Kœhler University of Glasgow
Now Postdoctoral Researcher at INRIA Strasbourg

2016–2020 Bastian Hagedorn together with Sergei Gorlatch, University of Münster
Only European receipient of the NVIDIA Graduate Fellowship 2019 worth $50K.
Selected as participant of the Heidelberg Laureate Forum 2019.
Winner of the disseration award 2021 at the University of Münster.
Now Research Engineer at NVIDIA

Second Supervisor of Graduate PhD Students

2016–2022 Federico Pizzuti main supervisor Christophe Dubach, University of Edinburgh
Now Researcher at Huawei Research Edinburgh

2015–2021 Larisa Stoltzfus main supervisor Christophe Dubach, University of Edinburgh
Now Software Engineer

2014–2019 Toomas Remmelg main supervisor Christophe Dubach, University of Edinburgh
Winner of the Estonian national contest for university students for his doctoral thesis
Now Senior Graphics Software Engineer at ARM

2015–2018 Michael Haidl main supervisor Sergei Gorlatch, University of Münster
Now Senior Compiler Engineer at NVIDIA

2015–2021 Juan José Fumero main supervisor Christophe Dubach, University of Edinburgh
Now Postdoctoral Research Associate at the University of Manchester

PhD Examinations

12/2022 Nicolas Tollenaere,INRIA Grenoble, France External Examiner

05/2022 Chris Perivolaropoulos,University of Edinburgh, UK Internal Examiner

12/2021 Chris Vasiladiotis,University of Edinburgh, UK Internal Examiner

08/2020 Bastian Hagedorn,University of Münster, Germany External Examiner

09/2019 Sebastian Ertel,TU Dresden, Germany External Examiner

09/2018 Blair Archibald,University of Glasgow, UK Internal Examiner

Publications

In my research communities publications in highly regarded conferences are much higher valued than journal publications.

Publication Statistics

I have published **72 papers**: *32 Journal and Conference Papers*, *25 Workshop Papers*, *13 Technical Reports*, and, *2 Book Chapters*.

Citations: 1377, **h-index: 19**, **i10-index: 26** (Google Scholar 26.07.2023)

Journal and Conference Papers

2024 [32] **BaCO: A Fast and Portable Bayesian Compiler Optimization Framework**

Erik Hellsten, Artur L. F. Souza, Johannes Lenfers, Rubens Lacouture, Olivia Hsu, Adel Ejjeh, Fredrik Kjolstad, **Michel Steuwer**, Kunle Olukotun and Luigi Nardi

Proceedings of the Twenty-Eighth International Conference on Architectural Support for Programming Languages and Operating Systems, ASPLOS 2024, CA, USA, April, 2024. ACM.

(accepted for publication)

2023 [31] **Structural Subtyping as Parametric Polymorphism**

Wenhao Tang, Daniel Hillerström, James McKinna, **Michel Steuwer**, Ornela Dardha, Rongxiao Fu and Sam Lindley

Proc. ACM Program. Lang. (PACMPL) 7.OOPSLA (2023).

(accepted for publication)

[30] **Achieving High Performance the Functional Way: Expressing High-Performance Optimizations as Rewrite Strategies**

Bastian Hagedorn, Johannes Lenfers, Thomas Kœhler, Xueying Qin, Sergei Gorlatch and **Michel Steuwer**

Commun. ACM (CACM) 66.3 (2023).

[29] **Primrose: Selecting Container Data Types by Their Properties**

Xueying Qin, Liam O'Connor and **Michel Steuwer**

Art Sci. Eng. Program. (<Programming>) 7.3 (2023).

2022 [28] **Collection Skeletons: Declarative Abstractions for Data Collections**

Björn Franke, Zhibo Li, Magnus Morton and **Michel Steuwer**

Proceedings of the 15th ACM SIGPLAN International Conference on Software Language Engineering, SLE 2022, Auckland, New Zealand, December 6-7, 2022. ACM.

Best Research Paper Award

[27] **Investigating magic numbers: improving the inlining heuristic in the Glasgow Haskell Compiler**

Celeste Hollenbeck, Michael F. P. O'Boyle and **Michel Steuwer**

Haskell '22: 15th ACM SIGPLAN International Haskell Symposium, Ljubljana, Slovenia, September 15 - 16, 2022. ACM.

[26] **Generating Work Efficient Scan Implementations for GPUs the Functional Way**

Federico Pizzuti, **Michel Steuwer** and Christophe Dubach

Euro-Par 2022: Parallel Processing - 28th International Conference on Parallel and Distributed Computing, Glasgow, UK, August 22-26, 2022, Proceedings. Lecture Notes in Computer Science 13440. Springer.

2021 [25] **Code Generation for Room Acoustics Simulations with Complex Boundary Conditions**

Larisa Stoltzfus, Brian Hamilton, **Michel Steuwer**, Lu Li and Christophe Dubach

35th IEEE International Parallel and Distributed Processing Symposium, IPDPS 2021, Portland, OR, USA, May 17-21, 2021. IEEE.

[24] **Integrating a functional pattern-based IR into MLIR**

Martin Lücke, **Michel Steuwer** and Aaron Smith

CC '21: 30th ACM SIGPLAN International Conference on Compiler Construction, Virtual Event, Republic of Korea, March 2-3, 2021. ACM.

[23] **Towards a Domain-Extensible Compiler: Optimizing an Image Processing Pipeline on Mobile CPUs**

Thomas Kœhler and **Michel Steuwer**

IEEE/ACM International Symposium on Code Generation and Optimization, CGO 2021, Seoul, South Korea, February 27 - March 3, 2021. IEEE.

[22] **Efficient Auto-Tuning of Parallel Programs with Interdependent Tuning Parameters via Auto-Tuning Framework (ATF)**

Ari Rasch, Richard Schulze, **Michel Steuwer** and Sergei Gorlatch

ACM Trans. Archit. Code Optim. (TACO) 18.1 (2021).

15 citations on Google Scholar.

2020 [21] **DelayRepay: delayed execution for kernel fusion in Python**

John Magnus Morton, Kuba Kaszyk, Lu Li, Jiawen Sun, Christophe Dubach, **Michel Steuwer**, Murray Cole and Michael F. P. O'Boyle

DLS 2020: Proceedings of the 16th ACM SIGPLAN International Symposium on Dynamic Languages, Virtual Event, USA, November 17, 2020. ACM.

[20] **Achieving high-performance the functional way: a functional pearl on expressing high-performance optimizations as rewrite strategies**

Bastian Hagedorn, Johannes Lenfers, Thomas Kœhler, Xueying Qin, Sergei Gorlatch and **Michel Steuwer**

Proc. ACM Program. Lang. (PACMPL) 4.ICFP (2020).

37 citations on Google Scholar, **selected as only 1 of 4 ACM SIGPLAN Research Highlights from 2020**, *HiPEAC Paper Award*, **selected for publication as a Communications of the ACM Research Highlight**.

[19] **Tiling Optimizations for Stencil Computations Using Rewrite Rules in Lift**

Larisa Stoltzfus, Bastian Hagedorn, **Michel Steuwer**, Sergei Gorlatch and Christophe Dubach

ACM Trans. Archit. Code Optim. (TACO) 16.4 (2020).

[18] **Generating fast sparse matrix vector multiplication from a high level generic functional IR**

Federico Pizzuti, **Michel Steuwer** and Christophe Dubach

CC '20: 29th International Conference on Compiler Construction, San Diego, CA, USA, February 22-23, 2020. ACM.

2018 [17] **Automatic Matching of Legacy Code to Heterogeneous APIs: An Idiomatic Approach**

Philip Ginsbach, Toomas Remmelg, **Michel Steuwer**, Bruno Bodin, Christophe Dubach and Michael F. P. O'Boyle

Proceedings of the Twenty-Third International Conference on Architectural Support for Programming Languages and Operating Systems, ASPLOS 2018, Williamsburg, VA, USA, March 24-28, 2018. ACM.

HiPEAC Paper Award. **35 citations** on Google Scholar.

[16] **High performance stencil code generation with Lift**

Bastian Hagedorn, Larisa Stoltzfus, **Michel Steuwer**, Sergei Gorlatch and Christophe Dubach

Proceedings of the 2018 International Symposium on Code Generation and Optimization, CGO 2018, Vösendorf / Vienna, Austria, February 24-28, 2018. ACM.

Best Paper Award Winner. **113 citations** on Google Scholar.

2017 [15] **A Transformation-Based Approach to Developing High-Performance GPU Programs**

Bastian Hagedorn, **Michel Steuwer** and Sergei Gorlatch

Perspectives of System Informatics - 11th International Andrei P. Ershov Informatics Conference, PSI 2017, Moscow, Russia, June 27-29, 2017, Revised Selected Papers. Lecture Notes in Computer Science 10742. Springer.

[14] **Just-In-Time GPU Compilation for Interpreted Languages with Partial Evaluation**

Juan José Fumero, **Michel Steuwer**, Lukas Stadler and Christophe Dubach

Proceedings of the 13th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments, VEE 2017, Xi'an, China, April 8-9, 2017. ACM.

38 citations on Google Scholar.

[13] **Lift: a functional data-parallel IR for high-performance GPU code generation**

Michel Steuwer, Toomas Remmelg and Christophe Dubach

Proceedings of the 2017 International Symposium on Code Generation and Optimization, CGO 2017, Austin, TX, USA, February 4-8, 2017. ACM.

203 citations on Google Scholar, **most cited paper of CGO 2017**.

2016 [12] **Matrix multiplication beyond auto-tuning: rewrite-based GPU code generation**

Michel Steuwer, Toomas Remmelg and Christophe Dubach

2016 International Conference on Compilers, Architectures and Synthesis for Embedded Systems, CASES 2016, Pittsburgh, Pennsylvania, USA, October 1-7, 2016. ACM.

33 citations on Google Scholar.

2015 [11] **Generating performance portable code using rewrite rules: from high-level functional expressions to high-performance OpenCL code**

Michel Steuwer, Christian Fensch, Sam Lindley and Christophe Dubach

Proceedings of the 20th ACM SIGPLAN International Conference on Functional Programming, ICFP 2015, Vancouver, BC, Canada, September 1-3, 2015. ACM.

177 citations on Google Scholar, **most cited paper of ICFP 2015**.

[10] **Runtime Code Generation and Data Management for Heterogeneous Computing in Java**

Juan José Fumero, Toomas Remmelg, **Michel Steuwer** and Christophe Dubach

Proceedings of the Principles and Practices of Programming on The Java Platform, PPPJ 2015, Melbourne, FL, USA, September 8-11, 2015. ACM.

27 citations on Google Scholar.

2014 [9] **High-Level Programming of Stencil Computations on Multi-GPU Systems Using the SkelCL Library**

Michel Steuwer, Michael Haidl, Stefan Breuer and Sergei Gorlatch

Parallel Processing Letters 24.3 (2014).

20 citations on Google Scholar.

[8] **gCUP: Rapid GPU-based HIV-1 Coreceptor Usage Prediction for Next-Generation Sequencing**

Michael Olejnik, **Michel Steuwer**, Sergei Gorlatch and Dominik Heider

Bioinformatics 30.22 (2014).

11 citations on Google Scholar.

[7] **SkelCL: A High-Level Extension of OpenCL for Multi-GPU Systems**

Michel Steuwer and Sergei Gorlatch

The Journal of Supercomputing 69.1 (2014).

23 citations on Google Scholar.

[6] **Introducing and Implementing the Allpairs Skeleton for Programming Multi-GPU Systems**

Michel Steuwer, Malte Friese, Sebastian Albers and Sergei Gorlatch

Int. J. Parallel Program. 42.4 (2014).

15 citations on Google Scholar.

[5] **Towards High-Level Programming for Systems with Many Cores**

Sergei Gorlatch and **Michel Steuwer**

Perspectives of System Informatics - 9th International Ershov Informatics Conference, PSI 2014, St. Petersburg, Russia, June 24-27, 2014. Revised Selected Papers. Lecture Notes in Computer Science 8974. Springer.

2013 [4] **dOpenCL: Towards uniform programming of distributed heterogeneous multi-/many-core systems**

Philipp Kegel, **Michel Steuwer** and Sergei Gorlatch

J. Parallel Distributed Comput. 73.12 (2013).

16 citations on Google Scholar.

[3] **High-Level Programming for Medical Imaging on Multi-GPU Systems Using the SkelCL Library**

Michel Steuwer and Sergei Gorlatch

Proceedings of the International Conference on Computational Science, ICCS 2013, Barcelona, Spain, 5-7 June, 2013. Procedia Computer Science 18. Elsevier.

[2] **SkelCL: Enhancing OpenCL for High-Level Programming of Multi-GPU Systems**

Michel Steuwer and Sergei Gorlatch

Parallel Computing Technologies - 12th International Conference, PaCT 2013, St. Petersburg, Russia, September 30 - October 4, 2013. Proceedings. Lecture Notes in Computer Science 7979. Springer.

37 citations on Google Scholar.

2012 [1] **A High-Level Programming Approach for Distributed Systems with Accelerators**

Michel Steuwer, Philipp Kegel and Sergei Gorlatch

New Trends in Software Methodologies, Tools and Techniques - Proceedings of the Eleventh SoMeT '12, Genoa, Italy, September 26 - 28, 2012. Frontiers in Artificial Intelligence and Applications 246. IOS Press.

Workshop Papers

2022 [W25] **Systematically extending a high-level code generator with support for tensor cores**

Lukas Siefke, Bastian Köpcke, Sergei Gorlatch and **Michel Steuwer**

GPGPU@PPoPP 2022: Proceedings of the 14th Workshop on General Purpose Processing Using GPU, Virtual Event, Seoul, Republic of Korea, 3 April 2022. ACM.

2021 [W24] **Generating high performance code for irregular data structures using dependent types**

Federico Pizzuti, **Michel Steuwer** and Christophe Dubach

FHPNC 2021: Proceedings of the 9th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2021, Virtual Event, Korea, August 22, 2021. ACM.

2020 [W23] **High-level hardware feature extraction for GPU performance prediction of stencils**

Toomas Remmelg, Bastian Hagedorn, Lu Li, **Michel Steuwer**, Sergei Gorlatch and Christophe Dubach

GPGPU@PPoPP '20: 13th Annual Workshop on General Purpose Processing using Graphics Processing Unit colocated with 25th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, San Diego, California, USA, February 23, 2020. ACM.

[W22] **A functional pattern-based language in MLIR**

Martin Lücke, **Michel Steuwer** and Aaron Smith

AccML@HiPEAC 2020: Proceeding of the workshop on Accelerated Machine Learning, Bologna, Italy, January 20, 2020.

2019 [W21] **Generating efficient FFT GPU code with Lift**

Bastian Köppcke, **Michel Steuwer** and Sergei Gorlatch

Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2019, Berlin, Germany, August 18, 2019. ACM.

[W20] **Position-dependent arrays and their application for high performance code generation**

Federico Pizzuti, **Michel Steuwer** and Christophe Dubach

Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2019, Berlin, Germany, August 18, 2019. ACM.

[W19] **Generating Fast FFT Code for GPU from High-Level Pattern-Based Abstractions**

Bastian Köpke, **Michel Steuwer** and Sergei Gorlatch

Proceedings of the International Symposium on High-Level Parallel Programming and Applications, HLPP 2019, Linköping, Sweden, July 3-5, 2019.

[W18] **High-level synthesis of functional patterns with Lift**

Martin Kristien, Bruno Bodin, **Michel Steuwer** and Christophe Dubach

Proceedings of the 6th ACM SIGPLAN International Workshop on Libraries, Languages and Compilers for Array Programming, ARRAY@PLDI 2019, Phoenix, AZ, USA, June 22, 2019. ACM.

20 citations on Google Scholar.

[W17] **Towards Mapping Lift to Deep Neural Network Accelerators**

Naums Mogers, Aaron Smith, Dimitrios Vytiniotis, **Michel Steuwer**, Christophe Dubach and Ryota Tomioka

Proceedings of the Workshop on Emerging Deep Learning Accelerators, EDLA@HiPEAC 2019, Valencia, Spain, January 21, 2019.

2018 [W16] **Introducing Parallelism to the Ranges TS**

Gordon Brown, Christopher Di Bella, Michael Haidl, Toomas Remmelg, Ruymán Reyes and **Michel Steuwer**

Proceedings of the International Workshop on OpenCL, IWOCL 2018, Oxford, United Kingdom, May 14-16, 2018. ACM.

2017 [W15] **A Modular Approach to Performance, Portability and Productivity for 3D Wave Models**

Larisa Stoltzfus, Christophe Dubach, **Michel Steuwer**, Alan Gray and Stefan Bilbao

Proceedings of the Seventh International Workshop on Domain-Specific Languages and High-Level Frameworks for High Performance Computing, WOLFHPC@SC 2017, Denver, CO, USA, November 17, 2017.

[W14] **OpenCL JIT Compilation for Dynamic Programming Languages**

Juan José Fumero, **Michel Steuwer**, Lukas Stadler and Christophe Dubach

Proceedings of the 2017 Workshop on Modern Language Runtimes, Ecosystems, and VMs, MoreVMs@<Programming> 2017, Brussels, Belgium, April 3, 2017.

[W13] **Towards Composable GPU Programming: Programming GPUs with Eager Actions and Lazy Views**

Michael Haidl, **Michel Steuwer**, Hendrik Dirks, Tim Humernbrum and Sergei Gorlatch

Proceedings of the 8th International Workshop on Programming Models and Applications for Multicores and Manycores, PMAM@PPoPP 2017, Austin, TX, USA, February 5, 2017. ACM.

2016 [W12] **Performance portable GPU code generation for matrix multiplication**

Toomas Remmelg, Thibaut Lutz, **Michel Steuwer** and Christophe Dubach

Proceedings of the 9th Annual Workshop on General Purpose Processing using Graphics Processing Unit, GPGPU@PPoPP 2016, Barcelona, Spain, March 12 - 16, 2016. ACM.

38 citations on Google Scholar.

[W11] **Multi-stage programming for GPUs in C++ using PACXX**

Michael Haidl, **Michel Steuwer**, Tim Humernbrum and Sergei Gorlatch

Proceedings of the 9th Annual Workshop on General Purpose Processing using Graphics Processing Unit, GPGPU@PPoPP 2016, Barcelona, Spain, March 12 - 16, 2016. ACM.

[W10] **Compositional Compilation for Sparse, Irregular Data Parallelism**

Adam Harries, **Michel Steuwer**, Murray Cole, Alan Gray and Christophe Dubach

Proceedings of the Workshop on High-Level Programming for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016, Prague, Czech Republic, January 19, 2016.

[W9] **Towards Collaborative Performance Tuning of Algorithmic Skeletons**

Chris Cummins, Pavlos Petoumenos, **Michel Steuwer** and Hugh Leather

Proceedings of the Workshop on High-Level Programming for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016, Prague, Czech Republic, January 19, 2016.

[W8] **Autotuning OpenCL Workgroup Size for Stencil Patterns**

Chris Cummins, Pavlos Petoumenos, **Michel Steuwer** and Hugh Leather

Proceedings of the 2016 International Workshop on Adaptive Self-tuning Computing Systems, ADAPT@HiPEAC 2016, Prague, Czech Republic, January 18, 2016.

35 citations on Google Scholar.

2014 [W7] **A Composable Array Function Interface for Heterogeneous Computing in Java**

Juan José Fumero, **Michel Steuwer** and Christophe Dubach

ARRAY'14: Proceedings of the 2014 ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming, Edinburgh, United Kingdom, June 12-13, 2014. ACM.

25 citations on Google Scholar.

[W6] **Extending the SkelCL Skeleton Library for Stencil Computations on Multi-GPU Systems**

Stefan Breuer, **Michel Steuwer** and Sergei Gorlatch

Proceedings of the 1st International Workshop on High-Performance Stencil Computations, HiStencils@HiPEAC 2014, Vienna, Austria, January 22, 2014.

20 citations on Google Scholar.

2012 [W5] **Using the SkelCL Library for High-Level GPU Programming of 2D Applications**

Michel Steuwer, Sergei Gorlatch, Matthias Buß and Stefan Breuer

Euro-Par 2012: Parallel Processing Workshops - BDMC, CGWS, HeteroPar, HiBB, OMHI, Paraphrase, PROPER, Resilience, UCHPC, VHPC, Rhodes Islands, Greece, August 27-31, 2012. Revised Selected Papers. Lecture Notes in Computer Science 7640. Springer.

[W4] **Uniform High-Level Programming of Many-Core and Multi-GPU Systems**

Philipp Kegel, **Michel Steuwer** and Sergei Gorlatch

Transition of HPC Towards Exascale Computing - Selected Papers from the High Performance Computing Workshop, Cetraro, Italy, June 25-29, 2012. Advances in Parallel Computing 24. IOS Press.

[W3] **Towards High-Level Programming of Multi-GPU Systems Using the SkelCL Library**

Michel Steuwer, Philipp Kegel and Sergei Gorlatch

26th IEEE International Parallel and Distributed Processing Symposium Workshops & PhD Forum, IPDPS 2012, Shanghai, China, May 21-25, 2012. IEEE Computer Society.

23 citations on Google Scholar.

[W2] **dOpenCL: Towards a Uniform Programming Approach for Distributed Heterogeneous Multi-/Many-Core Systems**

Philipp Kegel, **Michel Steuwer** and Sergei Gorlatch

26th IEEE International Parallel and Distributed Processing Symposium Workshops & PhD Forum, IPDPS 2012, Shanghai, China, May 21-25, 2012. IEEE Computer Society.

53 citations on Google Scholar.

2011 [W1] **SkelCL - A Portable Skeleton Library for High-Level GPU Programming**

Michel Steuwer, Philipp Kegel and Sergei Gorlatch

25th IEEE International Symposium on Parallel and Distributed Processing, IPDPS 2011, Anchorage, Alaska, USA, 16-20 May 2011 - Workshop Proceedings. IEEE.

192 citations on Google Scholar.

Technical Reports and Preprints

2023 [T13] **Descend: A Safe GPU Systems Programming Language**
Bastian Köpcke, Sergei Gorlatch and **Michel Steuwer**
arXiv abs/2305.03448 (2023).

[T12] **Traced Types for Safe Strategic Rewriting**
Rongxiao Fu, Ornela Dardha and **Michel Steuwer**
arXiv abs/2304.14154 (2023).

[T11] **Structural Subtyping as Parametric Polymorphism**
Wenhao Tang, Daniel Hillerström, James McKinna, **Michel Steuwer**, Ornela Dardha, Rongxiao Fu and Sam Lindley
arXiv abs/2304.08267 (2023).

2022 [T10] **BaCO: A Fast and Portable Bayesian Compiler Optimization Framework**
Erik Hellsten, Artur L. F. Souza, Johannes Lenfers, Rubens Lacouture, Olivia Hsu, Adel Ejjeh, Fredrik Kjolstad, **Michel Steuwer**, Kunle Olukotun and Luigi Nardi
arXiv abs/2212.11142 (2022).

[T9] **Primrose: Selecting Container Data Types by their Properties**
Xueying Qin, Liam O'Connor and **Michel Steuwer**
arXiv abs/2205.09655 (2022).

[T8] **RISE & Shine: Language-Oriented Compiler Design**
Michel Steuwer, Thomas Kœhler, Bastian Köpcke and Federico Pizzuti
arXiv abs/2201.03611 (2022).

2021 [T7] **Sketch-Guided Equality Saturation: Scaling Equality Saturation to Complex Optimizations in Languages with Bindings**
Thomas Kœhler, Phil Trinder and **Michel Steuwer**
arXiv abs/2111.13040 (2021).

[T6] **Row-Polymorphic Types for Strategic Rewriting**
Rongxiao Fu, Xueying Qin, Ornela Dardha and **Michel Steuwer**
arXiv abs/2103.13390 (2021).

2020 [T5] **A Language for Describing Optimization Strategies**

Bastian Hagedorn, Johannes Lenfers, Thomas Kœhler, Sergei Gorlatch and **Michel Steuwer**

arXiv abs/2002.02268 (2020).

2018 [T4] **P0836R0 Introduce Parallelism to the Ranges TS**

Gordon Brown, Christopher Di Bella, Michael Haidl, Toomas Remmelg, Ruyman Reyes, **Michel Steuwer** and Michael Wong

C++ Standards Committee Papers.

2017 [T3] **Strategy Preserving Compilation for Parallel Functional Code**

Robert Atkey, **Michel Steuwer**, Sam Lindley and Christophe Dubach

arXiv abs/1710.08332 (2017).

2015 [T2] **Patterns and Rewrite Rules for Systematic Code Generation (From High-Level Functional Patterns to High-Performance OpenCL Code)**

Michel Steuwer, Christian Fensch and Christophe Dubach

arXiv abs/1502.02389 (2015).

[T1] **Autotuning OpenCL Workgroup Size for Stencil Patterns**

Chris Cummins, Pavlos Petoumenos, **Michel Steuwer** and Hugh Leather

arXiv abs/1511.02490 (2015).

Book Chapter

2015 [B2]

Verbesserung der Programmierbarkeit und Performance-Portabilität von Manycore-Prozessoren (Improving Programmability and Performance Portability on Many-Core Processors)

Michel Steuwer

Ausgezeichnete Informatikdissertationen 2015 (Distinguished Dissertations in Informatics 2015). LNI D-16. GI.

2014 [B1]

Skeleton Programming for Portable Many-Core Computing

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Programming Multi-core and Many-core Computing Systems. Wiley.

Thesis

2015 [TH1]

Improving Programmability and Performance Portability on Many-Core Processors

Michel Steuwer

University of Münster.

Grade: **Summa Cum Laude**, **Nominated** for the **prize for best dissertation** awarded by the German Informatics Society.

Talks and Presentations

03/2023 **Invited Talk**: *On bringing a functional pearl into practice: An MLIR-based implementation of the strategy language ELEVATE*, LAIV/DSG seminar at Heriot-Watt University, Edinburgh, UK.

01/2023 **Invited Talk**: *On bringing a functional pearl into practice: An MLIR-based implementation of the strategy language ELEVATE*, Programming Languages at Glasgow (PLUG) seminar at the University of Glasgow, Glasgow, UK.

11/2022 **Invited Talk**: *Modern DSL Compiler Development with MLIR*, Huawei TRC Innovation Summit 2022, Tel Aviv, Israel.

06/2022 **Invited Talk**: *How to Design the Next 700 Optimizing Compilers*, High-efficiency computer graphics group at **MIT CSAIL**, Cambridge, MA, USA.

06/2022 Talk: *Achieving High-Performance the Functional Way: Expressing High-Performance Optimizations as Rewrite Strategies*, SIGPLAN Track at the SIGPLAN Conference on Programming Language Design and Implementation (PLDI), San Diego, CA, USA.

06/2022 **Invited Talk**: *RISE & Shine: Language-Oriented Compiler Design*, Compiler Design Lab Seminar at Saarland University, Saarland, Germany.

04/2022 Talk: *Systematically Extending a High-Level Code Generator with Support for Tensor Cores*, Workshop on General Purpose Processing using GPU (GPGPU), virtual.

09/2021 Talk: *FHPNC Community Update*, Workshop on Functional High- Performance and Numerical Computing (FHPNC), virtual.

12/2020 **Invited Talk**: *Achieving High-Performance the Functional Way - Expressing High-Performance Optimizations as Rewrite Strategies*, Programming Languages and Systems Research Group (PLAS) group seminar at the University of Kent, virtual.

08/2020 **Invited Talk**: *Compiler Intermediate Representations*, Scottish Programming Languages and Verification Summer School 2020 (SPLV 2020), virtual.

17/2020 Talk: *Achieving High-Performance the Functional Way - Expressing High-Performance Optimizations as Rewrite Strategies*, Scottish Programming Languages Seminar (SPLS), virtual.

09/2019 **Invited Talk**: *ELEVATE: a language to write composable program optimizations*, **Google DeepMind**, London, UK.

02/2019 **Invited Talk**: *Lift: Generating High Performance Code with Rewrite Rules*, Programming Languages and Software Engineering Group seminar at the **University of Washington**, Seattle, WA, USA.

02/2019 **Invited Talk**: *Lift: Generating High Performance Code with Rewrite Rules*, **Microsoft Research**, Redmond, WA, USA.

12/2018 Talk: *Implementing lambda calculus in Python and C++*, Programming Languages at Glasgow (PLUG) seminar at the University of Glasgow, Glasgow, UK.

11/2018 Talk: *High-level Features - Low-level Performance: GPU Performance Pre- diction of Stencils*, System Seminar at the University of Glasgow, Glasgow, UK.

09/2018 **Invited Talk**: *Generating Performance Portable Code with Lift*, **Shonan Meeting** No.134: Advances in Heterogeneous Computing from Hardware to Software, Shōnan, Japan.

03/2018 **Invited Talk**: *Lift: Code Generation by Rewriting Algorithmic Skeletons*, **Dagstuhl Seminar** 18111 on Loop Optimizations, Schloss Dagstuhl, Germany.

03/2018 **Invited Talk**: *Programming GPUs with Eager Actions and Lazy Views*, Compiler and Architecture Design Group Seminar at the University of Edinburgh, Edinburgh, UK.

02/2018 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, Formal Analysis, Theory and Algorithms Seminar at the University of Glasgow, Glasgow, UK.

11/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*, System Seminar at the University of Glasgow, Glasgow, UK.

11/2017 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, System Seminar at the University of Glasgow, Glasgow, UK.

10/2017 **Invited Talk**: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, **Microsoft Research**, Cambridge, UK.

09/2017 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, University of Hull HPC Symposium 2017, Hull, UK.

07/2017 **Invited Talk**: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, University of Münster, Münster, Germany.

06/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*, Scottish Programming Languages Seminar (SPLS) at the University of the West of Scotland, Paisley, UK.

04/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*, C++ Edinburgh Meetup, Edinburgh, UK.

02/2017 Talk: *Lift: A Functional Data-Parallel IR for High-Performance GPU Code Generation*, International Symposium on Code Generation and Optimization (CGO) 2017, Austin, TX, USA.

02/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*, International Workshop on Programming Models and Applications for Multicores and Manycores (PMAM) 2017, Austin, TX, USA.

12/2016 **Invited Talk**: *The Lift Project: Performance Portable GPU Code Generation via Rewrite Rules*, Computer Laboratory Systems Research Group Seminar at the **University of Cambridge**, Cambridge, UK.

08/2016 **Invited Talk**: *Structured Parallel Programming - From High-Level Func- tional Expressions to High-Performance OpenCL Code*, Center for Advanced Electornics at TU Dresden, Dresden, Germany.

05/2016 **Invited Talk**: *Improving Programmability and Performance Portability on Many-Core Processors*, Colloquium of candidates nominated for the prize for best dissertation awarded by the German Informatics Society, Scholss Dagstuhl, Germany.

04/2016 **Invited Talk**: *The Lift Project: Performance Portability via Rewrite Rules*, Compiler Design Lab Seminar at Saarland University, Saarland, Germany.

01/2016 **Invited Talk**: *Performance Portable GPU Code Generation*, Multicore Programming Group seminar at **Imperial College**, London, UK.

12/2015 Talk: *Functional Programming in C++*, Programming Language Interest Group at the University of Edinburgh, Edinburgh, UK.

10/2015 **Invited Talk**: *Generating Performance Portable Code using Rewrite Rules*, Multicore Programming Group seminar at **Imperial College**, London, UK.

09/2015 Talk: *Generating Performance Portable Code using Rewrite Rules: From High-Level Functional Expressions to High-Performance OpenCL Code*, International Conference on Functional Programming (ICFP) 2015, Vancouver, Canada.

06/2015 Talk: *Generating Performance Portable Code using Rewrite Rules*, Scottish Programming Languages Seminar (SPLS) at the University of St. Andrews, St. Andrews, UK.

05/2014 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*, Institute for Computational and Applied Mathematics at the University of Münster, Münster, Germany.

05/2014 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*, Workshop on Fast Data Processing on GPUs, Dresden, Germany.

01/2014 Talk: *Extending the SkelCL Library for Stencil Computations on Multi-GPU Systems*, HiStencils 2014 workshop, Vienna, Austria.

12/2013 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*, Research group on elementary particle physics at the University of Wuppertal, Wuppertal, Germany.

07/2013 Talk: *Introducing and Implementing the Allpairs Skeleton for GPU Systems*, HLPP 2013 workshop, Paris, France.

06/2013 Talk: *High-Level Programming for Medical Imaging on Multi-GPU Systems using the SkelCL Library*, ICCS 2013 conference, Barcelona, Spain.

08/2012 Talk: *Using the SkelCL Library for High-Level GPU Programming of 2D Applications*, ParaPhrase 2012 workshop, Rhodes, Greece.

06/2012 Talk: *High-Level Programming for Heterogeneous Systems with Accelerators*, PDESoft 2012 workshop, Münster, Germany.

05/2012 Talk: *Towards High-Level Programming of Multi-GPU Systems Using the SkelCL Library*, AsHES 2012 workshop, Shanghai, China.

04/2012 **Invited Talk**: *A Skeleton Library for Heterogeneous Multi-/Many-Core Systems*, NAIS workshop, Edinburgh, UK.

01/2012 Talk: *Towards a High-Level Approach for Programming Distributed Systems with GPUs*, COST Action IC0805 (“ComplexHPC”) meeting, Timisoara, Romania.

12/2011 **Invited Talk**: *SkelCL - A High-Level Programming Library for GPU Programming*, Jülich Supercomputing Centre (JSC), Jülich, Germany.

05/2011 Talk: *SkelCL - A Portable Skeleton Library for High-Level GPU Programming*, HIPS 2011 workshop, Anchorage, AK, USA.

09/2008 **Invited Talk**: *Development of an Online Game as a Student Project*, IT-Soft-TEAM workshop, Chernihiv, Ukraine.

Teaching Experience

As a Lecturer at the University of Edinburgh

2022–2023
- Lecturer for *Computer Systems*, undergraduate course, course lead by Vijay Nagarajan. About 250 students.
- Lecturer for *ompiling Techniques*, undergraduate course, course lead by Tobias Grosser. About 100 students.

2021–2022
- Lecturer for *Compiling Techniques*, undergraduate course, course lead by Tobias Grosser. About 100 students.
- Lecturer for *Operating Systems*, undergraduate course, course lead by Antonio Barbalace. About 150 students.

2020–2021
- Lecturer for *Operating Systems*, undergraduate course, course lead by Antonio Barbalace. About 150 students.

As a Lecturer at the University of Glasgow

2019–2020
- Lecturer for *Systems Programming*, undergraduate course. About 200 students.
- Lecturer for *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Craig Macdonald, Iadh Ounis, and Lito Michala. About 200 students.

2018–2019
- Lecturer for *Systems Programming*, undergraduate course. About 180 students.
- Lecturer for *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Inah Omoronyia, and Jeff Dalton. About 180 students.

2017–2018
- Lecturer for *Operating Systems*, undergraduate course, together with Wim Vanderbauwhede. About 80 students.
- Lecturer for *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Inah Omoronyia, and Joemon Jose. About 160 students.
- Lecturer for *MSc CS+ Team Project*, topic: *Developing a visual tool for exploring rewriting*. 6 Students.

As a postdoctoral researcher at the University of Edinburgh

2016–2017
- Guest lecture on *DSLs and rewrite-based optimizations for performance portable parallel programming* in the *Elements of Programming Languages* course give by James Cheney.
- Guest lecture in the *Compiling Techniques* course given by Christophe Dubach.
- Assistance in the tutorials of the *Compiling Techniques* course given by Christophe Dubach.

2015–2016
- Organiser and Lecturer of the C++ programming course *The Humble C++ Programmer* aiming to improve PhD students coding skills.
- Guest lecture on *DSLs and rewrite-based optimizations for performance portable parallel programming* in the *Elements of Programming Languages* course give by James Cheney.
- Assistance in the tutorials of the *Compiling Techniques* course given by Christophe Dubach.

2014–2015
- Guest lecture in the *Compiling Techniques* course given by Christophe Dubach.

As a research associate at the University of Münster

2013–2014
- Supervised MSc student group projects: *Design and implementation of a high-level API for programming heterogeneous clusters* and *High-level programming of online games in future generation networks*.

2012–2013
- Lecturer and Course Designer for *Introduction to progamming with C and C++*.
- Teaching assistant for *Multi-core and GPU: Parallel Programming*.
- Teaching assistant for *Operating Systems*.

2011–2012
- Supervised MSc student group project: *High-level programming of heterogeneous systems*.
- Teaching assistant for *Multi-core and GPU: Parallel Programming*.
- Teaching assistant for *Operating Systems*.
- Teaching assistnat for seminar on *Technical aspects of cloud computing*.

2010–2011
- Supervised UG/MSc student group project: *Internet- and GPU-based Cloud Computing*.
- Supervised UG student group project: *High-level GPU programming*.
- Lecturer and Course Designer for *Multi-core and GPU: Parallel Programming*.

Supervised Undergraduate and Master Students

As Lecturer at the University of Edinburgh

08/2022 MInf project of Limrod Liberman on
Applying the K Framework to specify the semantics of Domain-Specific Languages

08/2021 MSc project of Pingru Chen on
Templates for making correct graphs in research papers in the robotics domain

08/2021 MSc project of Zairan Xu on
Developing templates for better visualisation in machine learning research papers

08/2021 MSc project of Siqi Zong on
Templates for making correct graphs in research papers in the NLP domain

As Lecturer at the University of Glasgow

03/2020 Final year project of Xueying Qin on
Proving the correcness of rewrite rules in Agda

03/2020 Final year project of Sarah Ashworth on
Implementation of pattern-based computations on an FPGA

03/2020 Final year project of Euan Mcgrevey on
Optimizing image processing applications by rewriting

03/2020 Final year project of Darius Darulis on
Predicting the performance of rewritten program variations

03/2020 Final year project of David Wood on
Optimizing the compilation time of the Rust compiler

09/2019 Final year project of Ryan Maloney on
UFC Fight Prediction Web App

09/2019 Final year project of Stuart Rawlinson on
Scansion: A Poetry Analysis Web Application

09/2019 Final year project of Junjie Shentu on
Development of Ordering Application in Restaurants

09/2019 Final year project of Liam James on
Developing an Android Food Rating Application for Armature Chefs

03/2019 Final year project of Hansheng Zhang on
Multi-Level Parallel Applications with the C++ Parallel STL

03/2019 Final year project of Dimitar Borisov on
Exploiting specialised hardware for general purpose computing

03/2018 Final year project of Domantas Jurkus on
Computer Vision Applications with the Parallel STL

03/2018 Final year project of Matthew Cornetto on
Sorting Algorithms on GPUs

As research associate at the University of Münster

09/2016 Master project of Bastian Hagedorn on
Efficient GPU Code Generation for Stencil Computations via Parallel Patterns

07/2014 Bachelor project of André Lüers on
Evaluation of the Skeleton Library FastFlow

07/2014 Bachelor project of Lars Klein on
A Parallel Implementation of the T-CUP Software using the SkelCL Library

01/2014 Master project of Michael Olejnik on
A GPU-based Classification Framework for HIV Resistance Prediction

01/2014 Master project of Stefan Breuer on
Extending the SkelCL Library for Stencil Computations

11/2013 Diploma project of Wadim Hamm on
Development of a Divide & Conquer Skeleton for SkelCL

07/2013 Bachelor project of Matthias Droste on
Evaluation of the Skeleton Library SkePU

06/2013 Bachelor project of Kai Kientopf on
Implementation of the Needleman-Wunsch Algorithm and the Breath-First-Search with SkelCL

06/2013 Master project of Florian Quinkert on
A Model for Predicting Work Distribution in Heterogeneous Systems and its Implementation in SkelCL

03/2013 Master project of Malte Friese on
Extending the Skeleton Library SkelCL with a Skeleton for Allpairs Computations

03/2013 Bachelor project of Sebastian Mißbach on
Implementing the LU-Decomposition and the Mersenne-Twister with the SkelCL Library

03/2013 Bachelor project of Patrick Schiffler on
Performance Analysis of SkelCL using B+ Tree Traversal and 3D Jacobi Stencil Computation

01/2013 Diploma project of Markus Blank-Burian on
Simulation and Analysis of Two-Dimensional Turbulences on Parallel Computer Architectures

06/2012 Diploma project of Matthias Buß on
Adding Multidimensional Data Types to the Multi-GPU Skeleton Library SkelCL

09/2011 Bachelor project of Michael Olejnik on
Investigating the Use of GPUs for Radix Sort

09/2011 Bachelor project of Jan Gerd Tenberge on
Extending the SkelCL Library with Iterators

08/2011 Bachelor project of Stefan Breuer on
Enhancing SkelCL's MapOverlap Skeleton

08/2011 Bachelor project of Tobias Günnewig on
Developing a Library for Manipulating Source Code of C-based Languages