# Dr. Michel Steuwer

Informatics Forum
10 Crichton Street
Edinburgh EH8 9AB
United Kingdom
✉ michel.steuwer@ed.ac.uk



## Professional Experience

since July 2020 — **Lecturer (Assistant professor) in Compilers and Runtime Systems**, University of Edinburgh, UK.

2017–2020 — **Lecturer (Assistant professor)**, University of Glasgow, UK.

2014–2017 — **Postdoctoral Research Associate**, University of Edinburgh, 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 mathematics**, (eqivalent 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 will be published as a **Communications of the ACM Research Highlight** in 2023.
- **Best Paper Award Winner** at ACM **CGO 2018**.
- **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 candidates for the **prize for 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 University of Michigan, Arizona State in the US, and McGill in Canada.

## Research Community Activities

### Program Committees, Artifact Evaluation Committees & Reviewing

- **Program Committee Member** of Euro-Par 2023, ACM CGO 2022, 2020, 2019, ACM CC 2020, ACM GPCE 2020, 2019, ACM LCTES 2019, 2018, ICPP 2020, FHPNC 2021, 2020, HLPP 2020, 2019, 2018, 2017, 2016, DHPCC++ Workshop 2019, 2018, and IEEE ScalCom 2016.
- **Artifact Evaluation Committee Member** of ACM ICFP 2017, ACM CGO 2017, and ACM PACT 2016.
- **External reviewer for journals**: Communications of the ACM, ACM TODS, ACM TACO, ACM Computing Surveys, Science of Computer Programming Journal (Elsevier), The Journal of Supercomputing (Springer), and Software: Practice and Experience (Wiley).
- **External reviewer 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

- **Steering Committee Member** of CGO since 2021
- **General Chair** of PPoPP 2024
- **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 am 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—2021 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 11/2018 Thomas Kœhler University of Glasgow
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

2016 - 2020 Bastian Hagedorn together with Sergei Gorlatch, University of Münster
**Only European recipient of the NVIDIA Graduate Fellowship 2019 worth 50K$.**
**Selected as participant of the Heidelberg Laureate Forum 2019.**
**Winner of the dissertation awad 2021 at the University of Münster.**
Now Research Engineer at Nvidia

### Second Supervisor of Graduated 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 Applications Consultant at EPCC

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

2013 - 2017 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 **60 papers**: 8 Journal Articles, 20 Conference Papers, 24 Workshop Papers, 8 Technical Reports, and 3 Book Chapters.

**Overall citations: 1219**, **h-index: 18**, **i-index: 23** (Google Scholar 25.11.2022)

## Journal Articles

**2021** [J8] Ari Rasch, Richard Schulze, **Michel Steuwer**, and Sergei Gorlatch. "Efficient Auto-Tuning of Parallel Programs with Interdependent Tuning Parameters via Auto-Tuning Framework (ATF)". In: *ACM TACO* 18.1 (2021).

**2020** [J7] Bastian Hagedorn, Johannes Lenfers, Thomas Koehler, Xueying Qin, Sergei Gorlatch, and **Michel Steuwer**. "Achieving high-performance the functional way: a functional pearl on expressing high-performance optimizations as rewrite strategies". In: *Proc. ACM Program. Lang.* 4.ICFP (2020). 24 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**.

[J6] Larisa Stoltzfus, Bastian Hagedorn, **Michel Steuwer**, Sergei Gorlatch, and Christophe Dubach. "Tiling Optimizations for Stencil Computations Using Rewrite Rules in Lift". In: *ACM TACO* 16.4 (2020).

**2014** [J5] **Michel Steuwer**, Michael Haidl, Stefan Breuer, and Sergei Gorlatch. "High-Level Programming of Stencil Computations on Multi-GPU Systems Using the SkelCL Library". In: *Parallel Processing Letters* 24.3 (2014). 19 citations on Google Scholar.

[J4] Michael Olejnik, **Michel Steuwer**, Sergei Gorlatch, and Dominik Heider. "gCUP: Rapid GPU-based HIV-1 Coreceptor Usage Prediction for Next-Generation Sequencing". In: *Bioinformatics* 30.22 (2014). 11 citations on Google Scholar.

[J3] **Michel Steuwer** and Sergei Gorlatch. "SkelCL: A High-Level Extension of OpenCL for Multi-GPU Systems". In: *The Journal of Supercomputing* 69.1 (2014). **21 citations** on Google Scholar.

[J2] **Michel Steuwer**, Malte Friese, Sebastian Albers, and Sergei Gorlatch. "Introducing and Implementing the Allpairs Skeleton for Programming Multi-GPU Systems". In: *Int. Journal of Parallel Programming* 42.4 (2014). 14 citations on Google Scholar.

**2013** [J1] Philipp Kegel, **Michel Steuwer**, and Sergei Gorlatch. "dOpenCL: Towards uniform programming of distributed heterogeneous multi-/many-core systems". In: *Journal of Parallel and Distributed Computing* 73.12 (2013). 14 citations on Google Scholar.

### Conference Papers

**2022** [C20] Björn Franke, Zhibo Li, Magnus Morton, and **Michel Steuwer**. "Collection Skeletons: Declarative Abstractions for Data Collections". In: *SLE '22: 15th ACM SIGPLAN International Conference on Software Langauge Engineering, Auckland, New Zealand, December 6-7, 2022*. ACM.

[C19] Celeste Hollenbeck, Michael F. P. O'Boyle, and **Michel Steuwer**. "Investigating Magic Numbers: Improving the Inlining Heuristic in the Glasgow Haskell Compiler". In: *Haskell 2022: Proceedings of the 15th ACM SIGPLAN International Symposium on Haskell, Ljubljana, Slovenia, September 15-16, 2022*. ACM.

[C18] Federico Pizzuti, **Michel Steuwer**, and Christophe Dubach. "Generating Work Efficient Scan Implementations for GPUs the Functional Way". In: *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. Springer.

**2021** [C17] Larisa Stoltzfus, Brian Hamilton, **Michel Steuwer**, Lu Li, and Christophe Dubach. "Code Generation for Room Acoustics Simulations with Complex Boundary Conditions". In: *35th IEEE International Parallel and Distributed Processing Symposium, IPDPS 2021, May 17-21, 2021*. IEEE.

[C16] Martin Lücke, **Michel Steuwer**, and Aaron Smith. "Integrating a Functional Pattern-based IR into MLIR". In: *Proceedings of the ACM SIGPLAN 2021 International Conference on Compiler Construction, CC 2021, March 2-3, 2021*. ACM.

[C15] Thomas Koehler and **Michel Steuwer**. "Towards a Domain Extensible Compiler: Optimizing an image processing pipeline on mobile CPUs". In: *Proceedings of the 2021 International Symposium on Code Generation and Optimization, CGO 2021, February 27 - March 3, 2021*. IEEE.

**2020** [C14] John Magnus Morton, Kuba Kasyk, Lu Li, Jiawen Sun, Christophe Dubach, **Michel Steuwer**, Murray Cole, and Michael F. P. O'Boyle. "DelayRepay: Delayed Execution for Kernel Fusion in Python". In: *Proceedings of the 16th ACM SIGPLAN International Symposium on Dynamic Languages, DLS 2020, November 18, 2020*. ACM.

[C13] Federico Pizzuti, **Michel Steuwer**, and Christophe Dubach. "Generating Fast Sparse Matrix Vector Multiplication from a High Level Generic Functional IR". In: *Proceedings of the ACM SIGPLAN 2020 International Conference on Compiler Construction, CC 2020, San Diego, CA, USA, February 22-23, 2020*. ACM.

**2018** [C12] Philip Ginsbach, Toomas Remmelg, **Michel Steuwer**, Bruno Bodin, Christophe Dubach, and Michael F. P. O'Boyle. "Automatic matching of legacy code to heterogeneous APIs: An idiomatic approach". In: *Proceedings of the 23rd International Conference on Architectural Support for Programming Languages and Operating Systems, ASPLOS 2018, Williamsburg, VA, USA, March 24-28, 2018*. **HiPEAC Paper Award**, **28 citations** on Google Scholar. ACM.

[C11] Bastian Hagedorn, Larisa Stoltzfus, **Michel Steuwer**, Sergei Gorlatch, and Christophe Dubach. "High Performance Stencil Code Generation with Lift". In: *Proceedings of the 2018 International Symposium on Code Generation and Optimization, CGO 2018, Vienna, Austria, February 24-28, 2018*. **Best Paper Award Winner**, **99 citations** on Google Scholar. ACM.

**2017** [C10] Bastian Hagedorn, **Michel Steuwer**, and Sergei Gorlatch. "A Transformation-Based Approach to Developing High-Performance GPU Programs". In: *Perspectives of System Informatics - 11th International Ershov Informatics Conference, PSI 2017, Moscow, Russia, June 26-29, 2017*. Springer.

[C9] Juan José Fumero, **Michel Steuwer**, Lukas Stadler, and Christophe Dubach. "Just-In-Time GPU Compilation for Interpreted Languages with Partial Evaluation". In: *Proceedings of the 13th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments, VEE 2017, Xi'an, China, April 8-9, 2017*. **32 citations** on Google Scholar. ACM.

[C8] **Michel Steuwer**, Toomas Remmelg, and Christophe Dubach. "Lift: A Functional Data-Parallel IR for High-Performance GPU Code Generation". In: *Proceedings of the 2017 International Symposium on Code Generation and Optimization, CGO 2017, Austin, TX, USA, February 4-8, 2017*. **183 citations** on Google Scholar, **most cited paper of CGO 2017**. IEEE.

**2016** [C7] **Michel Steuwer**, Toomas Remmelg, and Christophe Dubach. "Matrix Multiplication Beyond Auto-Tuning: Rewrite-based GPU Code Generation". In: *Proceedings of the 2016 International Conference on Compilers, Architecture, and Synthesis of Embedded Systems, CASES 2016, Pittsburgh, USA, October 1-7, 2016*. **28 citations** on Google Scholar. ACM.

**2015** [C6] **Michel Steuwer**, Christian Fensch, Sam Lindley, and Christophe Dubach. "Generating Performance Portable Code using Rewrite Rules: From High-Level Functional Expressions to High-Performance OpenCL Code". In: *Proc. of the 20th ACM SIGPLAN International Conference on Functional Programming, ICFP 2015, Vancouver, BC, Canada, September 1-3, 2015*. **157 citations** on Google Scholar, **most cited paper of ICFP 2015**. ACM.

[C5] Juan José Fumero, Toomas Remmelg, **Michel Steuwer**, and Christophe Dubach. "Runtime Code Generation and Data Management for Heterogeneous Computing in Java". In: *Proceedings of the Principles and Practices of Programming on the Java Platform, PPPJ 2015, Melbourne, FL, USA, September 8-11, 2015*. **26 citations** on Google Scholar. ACM.

**2014** [C4] Sergei Gorlatch and **Michel Steuwer**. "Towards High-Level Programming for Systems with Many Cores". In: *Perspectives of Systems Informatics 9th International Andrei Ershov Memorial Conference (PSI 2014), St. Petersburg, Russia, June 24-27, 2014*. Springer.

**2013** [C3] **Michel Steuwer** and Sergei Gorlatch. "High-Level Programming for Medical Imaging on Multi-GPU Systems using the SkelCL Library". In: *Proc. of the Intl. Conference on Computational Science, ICCS 2013, Barcelona, Spain, 5-7 June, 2013*. Vol. 18. Procedia Computer Science. Elsevier.

[C2] **Michel Steuwer** and Sergei Gorlatch. "SkelCL: Enhancing OpenCL for High-Level Programming of Multi-GPU Systems". In: *Parallel Computing Technologies - 12th International Conference, PaCT 2013, St. Petersburg, Russia, September 30 - October 4, 2013*. Lecture Notes in Computer Science. **37 citations** on Google Scholar. Springer.

**2012** [C1] **Michel Steuwer**, Philipp Kegel, and Sergei Gorlatch. "A High-Level Programming Approach for Distributed Systems with Accelerators". In: *New Trends in Software Methodologies, Tools and Techniques - Proceedings of the Eleventh SoMeT '12, Genoa, Italy, September 26-28, 2012*. Vol. 246. Frontiers in Artificial Intelligence and Applications. IOS Press.

### Workshop Papers

**2022** [W24] Lukas Siefke, Bastian Köpcke, Sergei Gorlatch, and **Michel Steuwer**. "Systematically extending a high-level code generator with support for tensor cores". In: *GPGPU@PPoPP 2022: Proceedings of the 14th Workshop on General Purpose Processing Using GPU, 3 April 2022*. ACM.

**2021** [W23] Federico Pizzuti, **Michel Steuwer**, and Christophe Dubach. "Generating high performance code for irregular data structures using dependent types". In: *FHPNC@ICFP 2021: Proceedings of the 9th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, August 22, 2021*. ACM.

**2020** [W22] Toomas Remmelg, Bastian Hagedorn, Lu Li, **Michel Steuwer**, Sergei Gorlatch, and Christophe Dubach. "High-Level Hardware Feature Extraction for GPU Performance Prediction of Stencils". In: *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.

[W21] Martin Lücke, **Michel Steuwer**, and Aaron Smith. "A functional pattern-based language in MLIR". In: *AccML@HiPEAC 2020: Proc. of the workshop on Accelerated Machine Learning, Bologna, Italy, January 20, 2020*.

**2019** [W20] Bastian Köpcke, **Michel Steuwer**, and Sergei Gorlatch. "Generating efficient FFT GPU code with Lift". In: *FHPNC@ICFP 2019: Proc. of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, Berlin, Germany, August 18, 2019*. ACM.

[W19] Federico Pizzuti, **Michel Steuwer**, and Christophe Dubach. "Position-dependent arrays and their application for high performance code generation". In: *FHPNC@ICFP 2019: Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, Berlin, Germany, August 18, 2019*. ACM.

[W18] Bastian Köpke, **Michel Steuwer**, and Sergei Gorlatch. "Generating Fast FFT Code for GPU from High-Level, Pattern-Based Abstractions". In: *Proceedings of the International Symposium on High-Level Parallel Programming and Applications, HLPP 2019, Linköping, Sweden, July 3-5, 2019*.

[W17] Martin Kristien, Bruno Bodin, **Michel Steuwer**, and Christophe Dubach. "High-level synthesis of functional patterns with Lift". In: *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*. 17 citations on Google Scholar. ACM.

[W16] Naums Mogers, Aaron Smith, Dimitrios Vytiniotis, **Michel Steuwer**, Christophe Dubach, and Ryota Tomioka. "Towards Mapping Lift to Deep Neural Network Accelerators". In: *Proceedings of the Workshop on Emerging Deep Learning Accelerators, EDLA@HiPEAC 2019, Valencia, Spain, January 21, 2019*.

**2018** [W15] Gordon Brown, Christopher Di Bella, Michael Haidl, Toomas Remmelg, Ruyman Reyes, and **Michel Steuwer**. "Introducing Parallelism to the Ranges TS". In: *Proceedings of the International Workshop on OpenCL, IWOCL 2018, Oxford, United Kingdom, May 14-16, 2018*. ACM.

**2017** [W14] Larisa Stoltzfus, Christophe Dubach, **Michel Steuwer**, Alan Gray, and Stefan Bilbao. "A Modular Approach to Performance, Portability and Productivity for 3D Wave Models". In: *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*.

[W13] Juan José Fumero, **Michel Steuwer**, Lukas Stadler, and Christophe Dubach. "OpenCL JIT Compilation for Dynamic Programming Languages". In: *Proceedings of the 2017 Workshop on Modern Language Runtimes, Ecosystems, and VMs, MoreVMs@<Programming> 2017, Brussels, Belgium, April 3, 2017*.

[W12] Michael Haidl, **Michel Steuwer**, Hendrik Dirks, Tim Hummernbrum, and Sergei Gorlatch. "Towards Composable GPU Programming: Programming GPUs with Eager Actions and Lazy Views". In: *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** [W11] Toomas Remmelg, Thibaut Lutz, **Michel Steuwer**, and Christophe Dubach. "Performance Portable GPU Code Generation for Matrix Multiplication". In: *Proceedings of the 9th Annual Workshop on General Purpose Processing using Graphics Processing Unit, GPGPU@PPoPP 2016, Barcelona, Spain, March 12 - 16, 2016*. **35 citations** on Google Scholar. ACM.

[W10] Michael Haidl, **Michel Steuwer**, Tim Humernbrum, and Sergei Gorlatch. "Multi-Stage Programming for GPUs in Modern C++ using PACXX". In: *Proceedings of the 9th Annual Workshop on General Purpose Processing using Graphics Processing Unit, GPGPU@PPoPP 2016, Barcelona, Spain, March 12 - 16, 2016*. ACM.

[W9] Adam Harries, **Michel Steuwer**, Murray Cole, Alan Gray, and Christophe Dubach. "Compositional Compilation for Sparse, Irregular Data Parallelism". In: *Workshop on High-Level Programming for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016, Prague, Czech Republic, January 19, 2016*.

[W8] Chris Cummins, Pavlos Petoumenos, **Michel Steuwer**, and Hugh Leather. "Towards Collaborative Performance Tuning of Algorithmic Skeletons". In: *Workshop on High-Level Programming for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016, Prague, Czech Republic, January 19, 2016*.

[W7] Chris Cummins, Pavlos Petoumenos, **Michel Steuwer**, and Hugh Leather. "Autotuning OpenCL Workgroup Size for Stencil Patterns". In: *Proceedings of the 2016 International Workshop on Adaptive Self-tuning Computing Systems, ADAPT@HiPEAC 2016, Prague, Czech Republic, January 18, 2016*. **31 citations** on Google Scholar.

**2014** [W6] Juan José Fumero, **Michel Steuwer**, and Christophe Dubach. "A Composable Array Function Interface for Heterogeneous Computing in Java". In: *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*. **25 citations** on Google Scholar. ACM.

[W5] Stefan Breuer, **Michel Steuwer**, and Sergei Gorlatch. "Extending the SkelCL Skeleton Library for Stencil Computations on Multi-GPU Systems". In: *Proceedings of the 1st International Workshop on High-Performance Stencil Computations, HiStencils@HiPEAC 2014, Vienna, Austria, January 22, 2014*. 18 citations on Google Scholar.

**2012** [W4] **Michel Steuwer**, Philipp Kegel, and Sergei Gorlatch. "Towards High-Level Programming of Multi-GPU Systems Using the SkelCL Library". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Accelerators and Hybrid Exascale Systems, ASHES@IPDPS 2012, Shanghai, China, May 21-25, 2012*. **22 citations** on Google Scholar. IEEE.

[W3] **Michel Steuwer**, Sergei Gorlatch, Matthias Buß, and Stefan Breuer. "Using the SkelCL Library for High-Level GPU Programming of 2D Applications". In: *Euro-Par 2012: Parallel Processing Workshops, Paraphrase, Rhodes Islands, Greece, August 27-31, 2012*. Lecture Notes in Computer Science. Springer.

[W2] Philipp Kegel, **Michel Steuwer**, and Sergei Gorlatch. "dOpenCL: Towards a Uniform Programming Approach for Distributed Heterogeneous Multi-/Many-Core Systems". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Heterogeneity in Computing Workshop, HCW@IPDPS 2012, Shanghai, China, May 21-25,2012*. **53 citations** on Google Scholar. IEEE.

**2011** [W1] **Michel Steuwer**, Philipp Kegel, and Sergei Gorlatch. "SkelCL - A Portable Skeleton Library for High-Level GPU Programming". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Workshop on High-Level Parallel Programming Models & Supportive Environments, HIPS@IPDPS 2011, Anchorage, Alaska, USA, 16-20 May 2011*. **191 citations** on Google Scholar. IEEE.

### Technical Reports and Preprints

**2022** [T8] Xueying Qin, Liam O'Connor, and **Michel Steuwer**. "Primrose: Selecting Container Data Types by their Properties". In: *CoRR* abs/2205.09655 (2022).

[T7] **Michel Steuwer**, Thomas Koehler, Bastian Köpcke, and Federico Pizzuti. "RISE & Shine: Language-Oriented Compiler Design". In: *CoRR* abs/2201.03611 (2022).

**2021** [T6] Thomas Koehler, Phil Trinder, and **Michel Steuwer**. "Sketch-Guided Equality Saturation: Scaling Equality Saturation to Complex Optimizations in Languages with Bindings". In: *CoRR* abs/2111.13040 (2021).

[T5] Rongxiao Fu, Xueying Qin, Ornela Dardha, and **Michel Steuwer**. "Row-Polymorphic Types for Strategic Rewriting". In: *CoRR* abs/2103.13390 (2021).

**2020** [T4] Bastian Hagedorn, Johannes Lenfers, Thomas Koehler, Sergei Gorlatch, and **Michel Steuwer**. "A Language for Describing Optimization Strategies". In: *CoRR* abs/2002.02268 (2020).

**2018** [T3] Gordon Brown, Christopher Di Bella, Michael Haidl, Toomas Remmelg, Ruyman Reyes, **Michel Steuwer**, and Michael Wong. *P0836R0 Introduce Parallelism to the Ranges TS*. **C++ Standards Committee Papers**. 2018.

**2017** [T2] Robert Atkey, **Michel Steuwer**, Sam Lindley, and Christophe Dubach. "Strategy Preserving Compilation for Parallel Functional Code". In: *CoRR* abs/1710.08332 (2017). 11 citations on Google Scholar.

**2015** [T1] **Michel Steuwer**, Christian Fensch, and Christophe Dubach. "Patterns and Rewrite Rules for Systematic Code Generation (From High-Level Functional Patterns to High-Performance OpenCL Code)". In: *CoRR* abs/1502.02389 (2015).

### Book Chapters

**2016** [B3] **Michel Steuwer**. "Verbesserung der Programmierbarkeit und Performance-Portabilität von Manycore-Prozessoren (Improving Programmability and Performance Portability on Many-Core Processors)". In: *Ausgezeichnete Informatikdissertationen 2015 (Distinguished Dissertations in Informatics 2015)*. Ed. by Steffen Hölldobler. Lecture Notes in Informatics. German Informatics Society.

**2014** [B2] Christopher Kessler, Sergei Gorlatch, Johan Emmyren, Usman Dastgeer, **Michel Steuwer**, and Philipp Kegel. "Skeleton Programming for Portable Many-Core Computing". In: *Programming Multi-core and Many-core Computing Systems*. Wiley.

**2013** [B1] Philipp Kegel, **Michel Steuwer**, and Sergei Gorlatch. "Uniform High-Level Programming of Many-Core and Multi-GPU Systems". In: *Transition of HPC Towards Exascale Computing*. Vol. 24. Advances in Parallel Computing. IOS Press.

### Thesis

**2015** [TH1] **Michel Steuwer**. "Improving Programmability and Performance Portability on Many-Core Processors". Grade: Summa Cum Laude, **Nominated** for the **prize for best dissertation** awarded by the German Informatics Society. PhD thesis. University of Münster, 2015.

## Talks and Presentations

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**, US.

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

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

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

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

08/2020 Invited Lectures: *Compiler Intermediate Representations*, Scottish Programming Language and Verification Summer School, Hosted by the University of Edinburgh, UK.

06/2020 Talk: *Achieving High-Performance the Functional Way — Expressing High-Performance Optimizations as Rewrite Strategies*, Scottish Programming Languages Seminar, Hosted by the University of Sterling, UK.

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, **University of Washington in Seattle**, US.

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

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

11/2018 Talk: *High-level Features – Low-level Performance: GPU Performance Prediction of Stencils*, System Seminar, University of Glasgow, UK.

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

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

02/2018 **Invited Talk**: *Programming GPUs with Eager Actions and Lazy Views*, Compiler and Architecture Design Group Seminar, University of Edinburgh, UK.

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

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

10/2017 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*, System Seminar, University of Glasgow, UK.

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

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

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

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

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

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

08/2016 **Invited Talk**:, *Structured Parallel Programming — From High-Level Functional Expressions to High-Performance OpenCL Code*, Center for Advanced Electornics Dresden, Dresden University of Technology, 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, Schloss Dagstuhl, Germany.

04/2016 **Invited Talk**: *The lift Project: Performance Portability via Rewrite Rules*, Saarland University, Germany.

01/2016 **Invited Talk**: *Performance Portable GPU Code Generation*, Imperial College London, UK.

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

10/2015 **Invited Talk**: *Generating Performance Portable Code using Rewrite Rules*, **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 in Vancouver, Canada.

06/2015 Talk: *Generating Performance Portable Code using Rewrite Rules*, Scottish Programming Languages Seminar in St. Andrews, UK.

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

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

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

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

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

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

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

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

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

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

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

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

05/2011 Talk: *SkelCL — A Portable Skeleton Library for High-Level GPU Programming*, HIPS 2011 workshop held in conjunction with IPDPS 2011 in Anchorange, Alaska, USA.

09/2008 **Invited talk**: *Development of an Online Game as a Student Project*, ITSoftTEAM workshop in 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 *Compiling 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
- *Systems Programming*, undergraduate course. About 200 students.
- *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Craig Macdonald, Iadh Ounis, and Lito Michala. About 200 students.

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

2017 - 2018
- *Operating Systems*, undergraduate course, together with Wim Vanderbauwhede. About 80 students.
- *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Inah Omoronyia, and Joemon Jose. About 160 students.
- *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 given 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 given 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 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
- Course Design and Lecturer: *Introduction to programming with C and C++*.
- Teaching assistant: *Multi-core and GPU: Parallel Programming*.
- Teaching assistant: *Operating Systems*.

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

2010 - 2011
- Supervised UG/MSc student project: *Internet- and GPU-based Cloud Computing*.
- Course Design and teaching assistant: *Multi-core and GPU: Parallel Programming*.
- Supervised UG student project: *High-level GPU programming*.

## Supervised Undergraduate and Master Students

### As Lecturer at the University of Edinburgh.

09/2021 - 08/2022 MInf project of Limrod Libman on *Applying the K Framework to specify the semantics of Domain-Specific Languages*

06/2021 - 08/2021 MSc project of Pingru Chen on *Templates for making correct graphs in research papers in the robotics domain*

06/2021 - 08/2021 MSc project of Zairan Xu on *Developing templates for better visualisation in machine learning research papers*

06/2021 - 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.

09/2019 - 03/2020 Final year project of Xueying Qin on *Proving the correcness of rewrite rules in Agda*

09/2019 - 03/2020 Final year project of Sarah Ashworth on *Implementation of pattern-based computations on an FPGA*

09/2019 - 03/2020 Final year project of Euan Mcgrevey on *Optimizing image processing applications by rewriting*

09/2019 - 03/2020 Final year project of Darius Darulis on *Predicting the performance of rewritten program variations*

09/2019 - 03/2020 Final year project of David Wood on *Optimizing the compilation time of the Rust compiler*

06/2018 - 09/2019 Final year project of Ryan Maloney on *UFC Fight Prediction Web App*

06/2018 - 09/2019 Final year project of Stuart Rawlinson on *Scansion: A Poetry Analysis Web Application*

06/2018 - 09/2019 Final year project of Junjie Shentu on *Development of Ordering Application in Restaurants*

06/2018 - 09/2019 Final year project of Liam James on *Developing an Android Food Rating Application for Armature Chefs*

09/2018 - 03/2019 Final year project of Hansheng Zhang on *Multi-Level Parallel Applications with the C++ Parallel STL*

09/2018 - 03/2019 Final year project of Dimitar Borisov on *Exploiting specialised hardware for general purpose computing*

09/2017 - 03/2018 Final year project of Domantas Jurkus on *Computer Vision Applications with the Parallel STL*

09/2017 - 03/2018 Final year project of Matthew Cornetto on *Sorting Algorithms on GPUs*

As research associate at the University of Münster.

09/2016 MSc thesis of Bastian Hagedorn on *Efficient GPU Code Generation for Stencil Computations via Parallel Patterns*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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