

# Liam Keegan

Scientific Software Developer and High Performance Computing expert



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## About me

Experienced scientific software developer with excellent problem solving and computational skills.

Ability to work with complex multi-dimensional data, perform statistical analyses, extract relevant insights.

Experienced at communicating and explaining complex ideas and concepts; over 30 papers, conference proceedings and talks prepared.

## Experience

### 2020-present: Research Software Engineer

Scientific Software Center, University of Heidelberg, Germany

- C++/Python [development](#) & [teaching](#)

### 2019-2021: Scientific Software Developer

Department for modelling of biological processes, COS, University of Heidelberg, Germany

- C++/Qt software development of a [GUI tool](#) to edit and simulate spatial bio-chemical reaction models

### 2019 – 2019: Scientific Software Engineer, HPC

Blue Brain Project, EPFL, Geneva, Switzerland

- Adding symbolic math capabilities to a C++/Python [source-to-source compiler](#)

### 2017 – 2018: Postdoctoral Researcher

ETH, Zurich, Switzerland.

- Developing and optimising C++ [physics simulation codes](#)
- Implementing and testing [new algorithms](#)
- Teaching [C++ numerical simulation and data analysis course](#)
- Supervising Masters student Proseminars

### 2013 – 2016: Senior Fellow

CERN Theory Department, Geneva, Switzerland.

- Developing and optimising C/C++ MPI physics simulation codes
- Analyzing and visualising the resulting data using python/numpy/scipy
- Design and implementation of an open source [Python/PyQt GUI input file editor](#)

### 2011 – 2013: Postdoctoral Researcher

IFT UAM/CSIC, Madrid, Spain.

- Developing C/C++ MPI and Fortran physics simulation codes, running them on HPC clusters, analysing resulting data

## Education

### 2007 – 2011: PhD

- Edinburgh University, UK.  
PhD in Computational Physics.

### 2003 – 2007: MPhys

- Lincoln College, Oxford University, UK.  
MPhys in physics, 1st Class Honours, Lincoln College Scholar.

## Skills

### Communication

- Working with local and international teams from a wide variety of disciplines
- Giving technical seminars and international conference talks
- Preparing research papers

### Teaching

- Teaching courses on software development
- Teaching physics, maths and computing courses

### Software Development

- C / C++ / Python
- MPI / OpenMP / TBB
- Qt / PyQt
- Eigen / pybind11 / OpenCV
- Docker / Singularity
- Bash / Awk / Sed scripting
- Valgrind / Callgrind / ASAN
- Git / Subversion
- Unit testing / CI / CD
- CMake / Make
- Latex / BibTex
- Fortran
- Typescript / Javascript
- HTML / CSS

### Data analysis

- Statistical analysis of data
- Machine learning
- 2d and 3d visualisation
- Pandas / scikit-learn / Scipy
- Mathematica / Maple / Octave
- Matplotlib / Gnuplot

### Languages

- English: *native*
- French: *native*
- Spanish: *fluent*
- German: *intermediate*

## Publications

1. "Rational hybrid Monte Carlo with block solvers and multiple pseudofermions." Ph. de Forcrand, L. Keegan. Phys. Rev. E **98** (2018) 043306. <http://arxiv.org/abs/arXiv:1808.01829> IF: 2.366
2. "Initial conditions for hydrodynamics from weakly coupled pre-equilibrium evolution." L. Keegan, A. Kurkela, A. Mazeliauskas and D. Teaney. JHEP **1608** (2016) 171. <http://arxiv.org/abs/arXiv:1605.04287> IF: 6.023
3. "Weak and strong coupling equilibration in nonabelian gauge theories." L. Keegan, A. Kurkela, P. Romatschke, W. van der Schee and Y. Zhu. JHEP **1604** (2016) 031. <https://arxiv.org/abs/1512.05347> IF: 6.023
4. "Mass anomalous dimension of Adjoint QCD at large  $N$  from twisted volume reduction." M. Garcia Perez, A. Gonzalez-Arroyo, L. Keegan and M. Okawa JHEP **1508** (2015) 034. <http://arxiv.org/abs/1506.06536> IF: 6.023
5. "A comparison of updating algorithms for large  $N$  reduced models." M. Garcia Perez, A. Gonzalez-Arroyo, L. Keegan, M. Okawa and A. Ramos JHEP **1506** (2015) 193. <http://arxiv.org/abs/1505.05784> IF: 6.023
6. "The  $SU(\infty)$  twisted gradient flow running coupling." M. Garcia Perez, A. Gonzalez-Arroyo, L. Keegan and M. Okawa JHEP **1501** (2015) 038. <http://arxiv.org/abs/1412.0941> IF: 6.023
7. "MCRG Minimal Walking Technicolor." S. Catterall, L. Del Debbio, J. Giedt, L. Keegan Phys. Rev. D **85** (2012) 094501. <http://arxiv.org/abs/1108.3794> IF: 4.506
8. "Mass anomalous dimension in  $SU(2)$  with six fundamental fermions." F. Bursa, L. Del Debbio, L. Keegan, C. Pica and T. Pickup Phys. Lett. B **696** (2011) 374. <http://arxiv.org/abs/1007.3067> IF: 4.787
9. "Mass anomalous dimension in  $SU(2)$  with two adjoint fermions." F. Bursa, L. Del Debbio, L. Keegan, C. Pica and T. Pickup Phys. Rev. D **81** (2010) 014505. <http://arxiv.org/abs/0910.4535> IF: 4.506

## Conference Proceedings

1. "An optimizing multi-platform source-to-source compiler framework for the NEURON MODELing Language" Pramod Kumbhar, Omar Awile, Liam Keegan, Jorge Alonso, James King, Michael Hines and Felix Schürmann. ICCS 2020. [https://link.springer.com/chapter/10.1007/978-3-030-50371-0\\_4](https://link.springer.com/chapter/10.1007/978-3-030-50371-0_4)
2. "t Hooft model on the Lattice." M. G. Pérez, A. González-Arroyo, L. Keegan and M. Okawa, PoS Lattice 2016. <http://arxiv.org/abs/1612.07380>
3. "(Dimensional) twisted reduction in large  $N$  gauge theories." L. Keegan and A. Ramos, PoS Lattice 2015 <http://arxiv.org/abs/1510.08360>
4. "Schwinger Model Mass Anomalous Dimension." L. Keegan, PoS Lattice 2015. <http://arxiv.org/abs/1508.01685>
5. "Four-fermi anomalous dimension with adjoint fermions." L. Del Debbio, L. Keegan and C. Pena, PoS Lattice 2014
6. "TEK twisted gradient flow running coupling." M. Garcia Perez, A. Gonzalez-Arroyo, L. Keegan and M. Okawa, PoS Lattice 2014. <http://arxiv.org/abs/1411.0258>
7. "Anomalous dimensions of four-fermion operators from conformal EWSB dynamics." L. Del Debbio, L. Keegan and C. Pena, PoS Lattice 2013. <http://arxiv.org/abs/1311.4458>
8. "Mass anomalous dimension from large  $N$  twisted volume reduction." M. G. Perez, A. Gonzalez-Arroyo, L. Keegan and M. Okawa, PoS Lattice 2013. <http://arxiv.org/abs/1311.2395>
9. "Mass Anomalous Dimension at Large  $N$ ." L. Keegan, PoS Lattice 2012. <http://arxiv.org/abs/1210.7247>
10. "RG flows in 3D scalar field theory." L. Del Debbio, L. Keegan, PoS Lattice 2011
11. "Systematic Errors of the MCRG Method." S. Catterall, L. Del Debbio, J. Giedt, L. Keegan, PoS Lattice 2011. <http://arxiv.org/abs/1110.1660>
12. "MCRG Minimal Walking Technicolor." S. Catterall, L. Del Debbio, J. Giedt, L. Keegan, PoS Lattice 2010. <http://arxiv.org/abs/1010.5909>
13. "Mass anomalous dimension and running of the coupling in  $SU(2)$  with six fundamental fermions." F. Bursa, L. Del Debbio, L. Keegan, C. Pica and T. Pickup, PoS Lattice 2010. <http://arxiv.org/abs/1010.0901>
14. "Running of the coupling and quark mass in  $SU(2)$  with two adjoint fermions." F. Bursa, L. Del Debbio, L. Keegan, C. Pica and T. Pickup, PoS Lattice 2009. <http://arxiv.org/abs/0910.2562>

## Conference Talks

1. "Schwinger Model Mass Anomalous Dimension." Lattice 2015, Kobe, Japan. 14th-18th July 2015.
2. "TEK twisted gradient flow running coupling." Lattice 2014, Columbia University, New York. 23rd-28th June 2014.
3. "Mass anomalous dimension from large  $N$  twisted volume reduction." Lattice 2013, Mainz, Germany. 29th July-3rd Aug 2013.
4. "Large  $N$  volume reduction of MWT." Higgs Centre BSM Workshop, Edinburgh University, UK. 24th-26th April 2013.
5. "Mass Anomalous Dimension at Large  $N$ ." Lattice 2012, Cairns, Australia. 24th-29th June 2012.
6. "Systematic Errors of the MCRG Method." Lattice 2011, Lake Tahoe, USA. 10th-16th July 2011.
7. "MCRG Minimal Walking Technicolor." Workshop in memory of Jan Wennekers, Edinburgh, UK. 28th-29th March 2011.
8. "MCRG Minimal Walking Technicolor." Lattice 2010, Villasimius, Sardinia. 14th-19th June 2010.
9. "Walking Technicolor on the Lattice." MCFP Workshop on Large  $N$  Gauge Theories, University of Maryland, USA. 13th-15th May 2010.
10. "Strong Dynamics on the Lattice." UK High Energy Physics Young Theorists' Forum, Durham. 16th-17th Dec 2009.
11. "Walking Technicolor on the Lattice." UK High Energy Physics Young Theorists' Forum, University College London. 14th-15th May 2009.

## Seminars

1. "RHMC with multiple pseudofermions and block solvers." CERN, Switzerland, 27th Oct 2018.
2. "Large- $N$  twisted volume reduction of QCD on the lattice." Fermilab, Chicago, USA. 19th June 2014.
3. "Lattice Field Theory beyond QCD." CERN, Switzerland, 10th Jan 2014
4. "Mass Anomalous Dimension at Large  $N$ ." IFT/UAM-CSIC Madrid, Spain. 11th Oct 2012.
5. "Walking Technicolor on the Lattice." Valencia, Spain. 22nd Dec 2010.
6. "Minimal Walking Technicolor." Edinburgh, UK. 6th Jan 2010.