

Georg Hahn

Personal information

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Orcid: <https://orcid.org/0000-0001-6008-2720>
Date of birth: 22 Oct 1985
Place of birth: Mainz, Germany
Nationality: German

Employment

07/2019 – current

Harvard University, Cambridge, USA

- ▷ Research associate in the Department of Biostatistics, Harvard T.H. Chan School of Public Health. Additionally, I hold an *Instructor* appointment in the T.H. Chan School of Public Health.
- ▷ Work on novel multiple testing approaches in large-scale genetic, genomic and imaging data sets.

10/2017 – 04/2019

Lancaster University, United Kingdom

- ▷ Senior Research Associate in the *StatScale* project, a £2.8M EPSRC programme grant between both Lancaster University and the University of Cambridge to develop next generation statistical methods for streaming data.
- ▷ Work on anomaly and changepoint detection methods in online settings: includes methodology development, consistency proofs, simulation studies in *R*.

06/2016 – 09/2017

Imperial College London, United Kingdom

- ▷ Awarded an EPSRC doctoral prize fellowship of the Mathematics Department.
- ▷ Development of algorithms for multiple hypothesis testing, including finite time methods, *R* package release, theoretical work on closure properties of testing procedures, empirical project on gender bias in grant application success rates.

Education

09/2015 – 05/2016

Columbia University, New York, USA

- ▷ Post-doctoral student in the Columbia Statistics Department. Simultaneously external affiliate with Los Alamos National Laboratory for one year.
- ▷ Studies on empirical process theory, development of methodology for *broken-stick* and *broken-plane* regression allowing for superlinear convergence rates.

10/2011 – 05/2015

Imperial College London, United Kingdom

- ▷ Ph.D. in mathematics and statistics (awarded 01 Jul 2015). Doctoral thesis on “Statistical Methods for Monte-Carlo based Multiple Hypothesis Testing” (degree defense on 28 May 2015). *Ph.D. awarded without corrections.*

- ▷ Methodological work on multiple hypothesis testing with Monte Carlo approximated p-values, proof of correctness of developed methods, *R* package release, real data studies in *R*, development of multiple testing heuristics and theoretical frameworks incorporating existing methods, optimality results.

02/2011 – 06/2011

Universidad Complutense de Madrid, Spain

- ▷ Erasmus foreign study in Spain (one semester) as exchange student in physics.
- ▷ Modules in Spanish on algebraic geometry, time series, thermodynamics, atomic and quantum physics.

10/2009 – 06/2010

University of Cambridge, United Kingdom

- ▷ Certificate of Advanced Study in Mathematics/ Part III (awarded 17 Jun 2010, MA.St. awarded in retrospect on 22 Oct 2011): merit (beta+)
- ▷ Modules: commutative algebra, elliptic curves, statistical theory, time series and Monte Carlo inference, mathematics of operational research.
- ▷ Part III essay on block-sorting data compression.

05/2008 – 01/2011

Johannes Gutenberg University, Mainz, Germany

- ▷ M.Sc. in Mathematics (awarded 24 Jan 2011): overall grade 1.0
- ▷ Modules: algebraic number theory, number theory, local fields, algebraic geometry, stochastic calculus, partial differential equations, numerics of partial differential equations, minor: computer science.
- ▷ Master’s thesis on proving primality in polynomial time.

04/2006 – 10/2008

Johannes Gutenberg University, Mainz, Germany

- ▷ Intermediate diploma in Physics (awarded 20 Oct 2008): overall grade 1.4
- ▷ Modules: experimental physics, theoretical physics, mathematics, minor: computer science.

04/2005 – 05/2008

Johannes Gutenberg University, Mainz, Germany

- ▷ B.Sc. in Mathematics (awarded 08 May 2008): overall grade 1.2
- ▷ Modules: algebra, computer algebra, analysis, differential equations and function theory, numerical mathematics, stochastic calculus, topology, numerical solutions of differential equations, minor: computer science.
- ▷ Bachelor’s thesis on parallel integer factorisation using the *Quadratic Sieve*.

Research visits

05/2019 – 06/2019

Los Alamos National Laboratory, New Mexico, USA

- ▷ Invited to Los Alamos to work on the project “Optimizing the spin reversal transform on the D-Wave 2000Q”.
- ▷ Explored ways of increasing the precision of the D-Wave 2000Q annealer through applying a tailored spin reversal to the QUBO/Ising problem under consideration.

08/2018 – 09/2018

Lawrence Livermore National Laboratory, California, USA

- ▷ Invited for a project on scalable neuromorphic computing.
- ▷ Explored suitability of IBM's *TrueNorth* neuromorphic chip for solving quadratic unconstrained binary optimisation (QUBO) problems. Developed methods to transform QUBO connectivity structure and to assess/improve precision.

03/2018 – 04/2018

University of Cambridge (Isaac Newton Institute), United Kingdom

- ▷ Research stay in Cambridge as part of the *StatScale* cooperation.

03/2017 – 04/2017

Los Alamos National Laboratory, New Mexico, USA

- ▷ Invited to Los Alamos for the *LDRD Rapid Response* research project “Preprocessing Methods for Scalable Quantum Annealing”.
- ▷ Explored the use of *persistency* and *roof duality* methods to reduce the number of binary variables in Ising models, thus increasing problem sizes soluble on a quantum annealer. Code written in Python.

08/2016 – 09/2016

Los Alamos National Laboratory, New Mexico, USA

- ▷ Invited to Los Alamos for the *ISTI NSEC* research project “Efficient combinatorial optimization using quantum computing” using one of the world's three available *D-WAVE 2X* quantum annealers.
- ▷ Compared D-Wave to best available heuristics for two NP-hard graph problems in order to demonstrate a *quantum advantage* for the two problem classes.

06/2015 – 08/2015

Los Alamos National Laboratory, New Mexico, USA

- ▷ Selected as one of six participants of the *Information Science and Technology Center (ISTI/ASC) Co-Design Summer School* as a fully funded Ph.D. student.
- ▷ Extended state-of-the-art molecular dynamics software (in C++) with novel graph partitioning methods for faster molecular dynamics simulations.

08/2014 – 09/2014

Columbia University, New York, USA

- ▷ Research visit of the Mailman School of Public Health during my Ph.D.
- ▷ Work on central limit theorems in physics with Professor Ian McKeague, Columbia University. Conducted simulations in *R* and contributed to shortening of proofs.

11/2010 – 01/2011

Max Planck Institute for polymer research, Mainz, Germany

- ▷ Internship: student assistant programmer under the guidance of Dr Christoph Junghans and Dr Victor Rühle.
- ▷ Software development in C++ for the institute's *VOTCA* molecular dynamics package (spline fitting, documentation, php scripts for the *VOTCA* webpage).

Publications

Journal publications:

✉ denotes corresponding author

1. Pelofske, E.[✉], Hahn, G., O'Malley, D., Djidjev, H., and Alexandrov, B. (2022). Quantum annealing algorithms for Boolean tensor networks. *Sci Rep*, 12, 8539.
2. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2022). Parallel quantum annealing. *Sci Rep*, 12, 4499.
3. Hahn, G.[✉], Prokopenko, D., Lutz, S., Mullin, K., Tanzi, R., Cho, M., Silverman, E., and Lange, C. (2022). A Smoothed Version of the Lasso Penalty for Fitting Integrated Risk Models Using Summary Statistics or Individual-Level Data. *Genes*, 13(1):112.
4. Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2022). Inferring the Dynamics of the State Evolution During Quantum Annealing. *IEEE T Parall Distr*, 33(2):310–321.
5. Hahn, G.[✉](2022). Online multivariate changepoint detection with type I error control and constant time/memory updates per series. *Stat Probabil Lett*, 181:109258.
6. Hahn, G.[✉], Wu, C., Lee, S., Lutz, S., Khurana, S., Baden, L., Haneuse, S., Qiao, D., Hecker, J., DeMeo, D., Tanzi, R., Choudhary, M., Etemad, B., Mohammadi, A., Esmaeilzadeh, E., Cho, M., Li, J., Randolph, A., Laird, N., Weiss, S., Silverman, E., Ribbeck, K., and Lange, C. (2021). Genome-wide association analysis of COVID-19 mortality risk in SARS-CoV-2 genomes identifies mutation in the SARS-CoV-2 spike protein that colocalizes with P.1 of the Brazilian strain. *Genet Epidemiol*, 45(7):685–693.
7. Barbosa, A., Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2021). Using machine learning for quantum annealing accuracy prediction. *Algorithms*, 14(6), 187.
8. Hahn, G.[✉], Lutz, S., Laha, N., Cho, M., Silverman, E., and Lange, C. (2021) A fast and efficient smoothing approach to LASSO regression and an application in statistical genetics: polygenic risk scores for chronic obstructive pulmonary disease (COPD). *Stat Comput*, 31(35):1–11.
9. Hahn, G.[✉], Lee, S., Weiss, S., and Lange, C. (2021). Unsupervised cluster analysis of SARS-CoV-2 genomes reflects its geographic progression and identifies distinct genetic subgroups of SARS-CoV-2 virus. *Genet Epidemiol*, 45(3):316–323.
10. Hahn, G.[✉], Lutz, S., Hecker, J., Prokopenko, D., Cho, M., Silverman, E., Weiss, S., and Lange, C. (2021). locStra: Fast analysis of regional/global stratification in whole genome sequencing (WGS) studies. *Genet Epidemiol*, 45(1):82–98.
11. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2021). Decomposition Algorithms for Solving NP-hard Problems on a Quantum Annealer. *J Sign Process Syst*, 93:405–420.
12. Hahn, G.[✉], Fearnhead, P., and Eckley, I. (2020). BayesProject: Fast computation of a projection direction for multivariate changepoint detection. *Stat Comput*, 30:1691–1705.
13. Hahn, G.[✉](2020). On the expected runtime of multiple testing algorithms with bounded error. *Stat Probabil Lett*, 165:108844.
14. Gandy, A., Hahn, G.[✉], and Ding, D. (2019). Implementing Monte Carlo Tests with P-value Buckets. *Scand J Stat*, 47(3):950–967.

15. Ding, D., Gandy, A., and Hahn, G. [✉](2019). A simple method for implementing Monte Carlo tests. *Computation Stat*, 35:1373–1392.
16. Hahn, G. [✉](2019). Optimal allocation of Monte Carlo simulations to multiple hypothesis tests. *Stat Comput*, 30:571–586.
17. Djidjev, H., Hahn, G. [✉], Mniszewski, S., Negre, C., and Niklasson, A. (2019). Using Graph Partitioning for Scalable Distributed Quantum Molecular Dynamics. *Algorithms*, 12(9), 187. *Invited article for the Special Issue on Graph Partitioning: Theory, Engineering, and Applications*.
18. Chapuis, G., Djidjev, H., Hahn, G. [✉], and Rizk G. (2019). Finding Maximum Cliques on the D-Wave Quantum Annealer. *J Sign Process Syst*, 91(3–4):363–377.
19. Hahn, G. [✉](2018). Closure properties of classes of multiple testing procedures. *AStA Adv Stat Anal*, 102(2):167–178.
20. Ghale, P., Kroonblawd, M., Mniszewski, S., Negre, C., Pavel, R., Pino, S., Sardeshmukh, V., Shi, G., and Hahn, G. [✉](2017). Task-based Parallel Computation of the Density Matrix in Quantum-based Molecular Dynamics using Graph Partitioning. *SIAM J Sci Comput*, 39(6):C466–C480.
21. Gandy, A. and Hahn, G. [✉](2017). QuickMMCTest: quick multiple Monte Carlo testing. *Stat Comput*, 27:823–832.
22. Gandy, A. and Hahn, G. [✉](2016). A framework for Monte Carlo based multiple testing. *Scand J Stat*, 43(4):1046–1063.
23. Gandy, A. and Hahn, G. [✉](2014). MMCTest – A Safe Algorithm for Implementing multiple Monte Carlo tests. *Scand J Stat*, 41(4):1083–1101.

Other publications:

1. Hahn, G. [✉], Cho, M., Weiss, S., Silverman, E., and Lange, C. (2020). Unsupervised cluster analysis of SARS-CoV-2 genomes indicates that recent (June 2020) cases in Beijing are from a genetic subgroup that consists of mostly European and South(east) Asian samples, of which the latter are the most recent. [bioRxiv:2020.06.22.165936](https://doi.org/10.1101/2020.06.22.165936).
2. Gandy, A. [✉], Noven, R., and Hahn, G. (2018). Does the success of a grant application depend on gender, nationality, or ethnicity? An observational study. [SSRN:3272738](https://doi.org/10.21203/rs.3.rs-1987111/v1).
3. Hahn, G. [✉], Banerjee, M., and Sen, B. (2017). Parameter estimation and inference in a two piece broken hyperplane model. *Paper preprint*.
4. Djidjev, H., Chapuis, G., Hahn, G., and Rizk, G. (2016). Efficient Combinatorial Optimization Using Quantum Annealing. *Los Alamos Natl Lab Report*. [arXiv:1801.08653](https://arxiv.org/abs/1801.08653).
5. Hahn, G. (2015). Statistical Methods for Monte-Carlo based Multiple Hypothesis Testing. *Doctoral thesis at Imperial College London*.
6. Hahn, G. (2011). Polynomielle Primzahltests mit elliptischen Kurven. *Master thesis at the University of Mainz* (translation: *Polynomial primality tests with elliptic curves*).
7. Hahn, G. (2010). Block-Sorting Data Compression. *Cambridge Part III Essay*.

8. Hahn, G. (2008). Parallelisierte Faktorisierung mit dem Quadratischen Sieb. Bachelor thesis at the University of Mainz (translation: *Parallelised factorisation using the quadratic sieve*).

Conference papers:

1. Pelofske, E.[✉], Hahn, G., O'Malley, D., Djidjev, H., and Alexandrov, B. (2021). Boolean Hierarchical Tucker Networks on Quantum Annealers. *13th International Conference on Large-Scale Scientific Computing LSSC 2021* and arXiv:2103.07399.
2. Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2021). Reducing quantum annealing biases for solving the graph partitioning problem. *Computing Frontiers Conference CF'21* and arXiv:2103.04963.
3. Barbosa, A., Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2020). Optimizing embedding-related quantum annealing parameters for reducing hardware bias. *PAAP 2020: Parallel Architectures, Algorithms and Programming* and arXiv:2011.00719.
4. Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2020). Advanced unembedding techniques for quantum annealers. *IEEE Intl Conference on Rebooting Computing 2020* and arXiv:2009.05028.
5. Pelofske, E., Hahn, G.[✉], and Djidjev, H. (2020). Advanced anneal paths for improved quantum annealing. *IEEE Quantum Week QCE20* and arXiv:2009.05008.
6. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2019). Peering into the Anneal Process of a Quantum Annealer. *The 20th Intl Conference on Parallel and Distributed Computing, Applications and Technologies PDCAT 2019* and arXiv:1908.02691.
7. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2019). Optimizing the spin reversal transform on the D-Wave 2000Q. *Proceedings of the IEEE Intl Conference on Rebooting Computing 2019* and arXiv:1906.10955.
8. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2019). Solving large Minimum Vertex Cover problems on a quantum annealer. *Proceedings of the Computing Frontiers Conference CF'19* and arXiv:1904.00051.
9. Pelofske, E.[✉], Hahn, G., and Djidjev, H. (2019). Solving large Maximum Clique problems on a quantum annealer. *Proceedings of the Intl Workshop on Quantum Technology and Optimization Problems QTOP 2019* and arXiv:1901.07657.
10. Hahn, G. and Djidjev, H. (2017). Reducing Binary Quadratic Forms for More Scalable Quantum Annealing. *IEEE Intl Conference on Rebooting Computing 2017* and arXiv:1801.08652.
11. Chapuis, G., Djidjev, H., Hahn, G., and Rizk, G. (2017). Finding Maximum Cliques on a Quantum Annealer. *Proceedings of the Computing Frontiers Conference CF'17* and arXiv:1801.08649v1.
12. Pino, S., Kroonblawd, M., Ghale, P., Hahn, G., Sardeshmukh, V., Shi, G., Djidjev, H., Negre, C., Pavel, R., Bergen, B., Mniszewski, S., and Junghans, C. (2015). Task-based parallel computation of the density matrix in quantum-based molecular dynamics using graph partitioning. *Supercomputing sc15* and poster pdf.
13. Djidjev, H., Hahn, G., Mniszewski, S., Negre, C., Niklasson, A., and Sardeshmukh,

V. (2015). Graph Partitioning Methods for Fast Parallel Quantum Molecular Dynamics. SIAM Workshop on Combinatorial Scientific Computing (CSC16) and arXiv:1605.01118.

Preprints/ Under review:

1. Hahn, G., Lee, S., Prokopenko, D., Abraham, J., Novak, T., Hecker, J., Cho, M., Khurana, S., Baden, L., Randolph, A., Weiss, S., and Lange, C. (2022). Unsupervised outlier detection applied to SARS-CoV-2 nucleotide sequences can identify sequences of common variants and other variants of interest. bioRxiv:2022.05.16.492178. *Under review*.
2. Hahn, G., Lee, S., Prokopenko, D., Novak, T., Hecker, J., Khurana, S., Baden, L., Randolph, A., Weiss, S., and Lange, C. (2022). Unsupervised genome-wide cluster analysis: nucleotide sequences of the omicron variant of SARS-CoV-2 are similar to sequences from early 2020. bioRxiv:2021.12.29.474469. *Under review*.
3. Hahn, G.[✉], Lutz, S., Laha, N., and Lange, C. (2022). A framework to efficiently smooth L1 penalties for linear regression. bioRxiv:2020.09.17.301788. *Under review*.
4. Hahn, G.[✉](2019). Lossless manipulation of QUBO and Ising connectivity structures. *Draft in preparation*.
5. Hahn, G.[✉](2019). Solving NP-complete problems with projections. *Draft in preparation*.

Selected invited talks and posters

1. *International Genetic Epidemiology Society IGES 2020*, invitation to speak at the special session on the genetic epidemiology of COVID-19 on 04 July 2020.
2. Invited talk on “Preprocessing a QUBO for Quantum Annealing” at the *D-Wave Users Meeting* in Newport, RI, from 23–25 Sept 2019 funded by Los Alamos National Laboratory.
3. Invited talk on “Preprocessing a QUBO for Quantum Annealing” in the *Information Science and Technology Seminar Speaker Series* of Los Alamos National Laboratory, 04 June 2019.
4. Invited talk on “Computational effort of multiple hypothesis testing” at the *Jerusalem Joint Statistical Event 2018* in Jerusalem, Israel, 20 Dec 2018.
5. Invited talk of equal title in the *Stat/Data/UQ Seminar Series* of the Statistics Department of the University of Manchester, 20 Nov 2018.
6. Invited talk on “Quadratic unconstrained binary optimisation and recent advances in quantum annealing” in the *CQIF Seminar Series* of the Statistical Laboratory of the University of Cambridge, 08 Nov 2018.
7. Lecture on “Selected topics in Multiple Hypothesis Testing and Quantum Annealing” in the *ASG Data Sciences Seminar* of Lawrence Livermore National Laboratory, 11 Sept 2018.
8. Invited talk on “Recent Advances in Quantum Annealing and Outlook on its Potential in Statistics” at the Isaac Newton Institute, University of Cambridge, 12 Apr 2018.
9. Invited poster presentation at the Salishan Conference on High-Speed Computing 2017 at the Salishan Lodge in Gleneden Beach, OR, from 24–27 Apr 2017.

10. Invited talk for the contributed session *High and infinite dimensional time series analysis* at *ERCIM 2016 (CMStatistics)* in Seville, Spain, from 09–11 Dec 2016.
11. Invited talk at the *Spotify* headquarters in New York on “Monte Carlo based Multiple Testing”, 20 Oct 2016.
12. Lecture in the *CCS-6 Statistical Sciences Seminar Series* of Los Alamos National Laboratory on “A Framework for Monte Carlo based Multiple Testing”, 22 Sep 2016.

Software packages

1. Author and maintainer of the *R*-packages `fastOnlineCpt`, `smoothedLasso`, `locStra`, and `BayesProject` on CRAN. Written in *R* and *C++*.
2. Co-author of the `simctest` *R*-package on CRAN, specifically author of the class `mmctest`. Written in *R*.
3. Author of the `ecpp` package for *SAGE*. Written in *SAGE/Python*.
4. Contributor to the `VOTCA` package for molecular dynamics simulation (modules for spline fitting, maintenance of analysis modules, documentation, php scripts for webpage) of the Max Planck Institute for polymer research, Germany. Written in *C++*.
5. Contributor to the *PROGRESS* package for quantum molecular dynamics at Los Alamos (specifically graph partitioning methods of the density matrix to speed up computations). Written in *C++*. Internal use at Los Alamos National Laboratory only.
6. The `MMCTest` algorithm (see publications) has been made available for *MathWorks* by independent author Dylan Muir. Written in *Matlab*.

Scholarship awards, Travel grants, Prizes

Academic scholarships and awards:

1. Extension of my EPSRC doctoral prize fellowship for a two month teaching commitment at Imperial College London in Jan and Feb 2017 (£4,300).
2. EPSRC post-doctoral prize fellowship of £47,094 to continue research at Imperial College London for one year (06 Jun 2016 to 30 Sept 2017).
3. Roth scholarship to cover living expenses in London (academic years 2012–15): £15,590 (per annum) for a period of 2.5 years (total £38,975).
4. DAAD scholarship: external funding of €12,000 (academic year 2011–12) provided by the German Academic Exchange Service DAAD.
5. EPSRC (*Engineering and Physical Sciences Research Council*) scholarship to cover university fees at Imperial College London from 2011–15: £3,732 (per annum) for 3.5 years (total £13,062).
6. Erasmus scholarship for one exchange semester in Spain in 2011 (€2,000).

Research grants:

1. *Faculty Researcher Guest Agreement* invite to Los Alamos National Laboratory from 05 May to 08 June 2019 to participate in research on D-Wave’s spin reversal (\$7,500).

2. VSP (visiting scientists and professionals) invite to Lawrence Livermore National Laboratory from 06 Aug to 15 Sept 2018 to participate in current laboratory research (\$16,500).
3. Award of a *Research Impulse* grant by Imperial College London for a talk at the *10th International Conference on Multiple Comparison Procedures* from 20–23 Jun 2017 (£850).
4. Grant for a two-month research project (May and Jun 2017) on *Gender bias in grant application success rates* at Imperial College London (£4,300).
5. *LDRD Rapid Response* project funding for “Preprocessing Methods for Scalable Quantum Annealing” at Los Alamos National Laboratory in Mar and Apr 2017 (\$8,000).
6. *ISTI NSEC* project funding for “Efficient combinatorial optimization using quantum computing” at Los Alamos National Laboratory in Aug and Sept 2016 (\$10,000).
7. Invitation by Los Alamos National Laboratory to participate at its IS&T Co-Design Summer School from May to Aug 2015 (\$12,000 stipend and \$1,300 travel grant).

Other awards:

1. Travel grant by Los Alamos National Laboratory to present at the *IEEE Intl Conference on Rebooting Computing 2019* in San Mateo, CA, from 06–08 Nov 2019 (\$1,500).
2. Travel grant by Los Alamos National Laboratory to present at the *D-Wave Users Meeting* in Newport, RI, from 23–25 Sept 2019 (\$600).
3. Travel grant by Los Alamos National Laboratory to present at the *Computing Frontiers Conference CF’19* in Alghero, Sardinia, Italy, from 30 April to 02 May 2019 (\$1,400).
4. Travel grant by Los Alamos National Laboratory to present at the *IEEE Conference on Rebooting Computing* in Washington, DC, from 06–07 Nov 2017 (\$500).
5. Invitation to the *Salishan Conference on High-Speed Computing 2017* from 24–27 Apr 2017 which included flights, rental car and accommodation (total \$890).
6. Travel grant by Los Alamos National Laboratory to participate in the *D-Wave “Qubits” Users Conference* in Santa Fe, NM, from 27–29 Sep 2016 (\$300).
7. Winner in category *Materials Science* and *Spot Award* (\$250) for best interdisciplinary work at the *2015 Student Symposium* poster competition, Los Alamos, Aug 2015.
8. EPSRC travel grant for the JSM2014 (Joint Statistical Meeting) conference in Boston, MA, and a research visit at Columbia University in New York, NY, in Aug 2014 (total £2,300).
9. Imperial College London yearly travel grants: £500 (per annum) for a period of 3.5 years from 2011 to 2015 (total £1,750).
10. Winner of best statistics poster (£200) twice during internal poster competitions of the Mathematics Department of Imperial College London, 13 Mar 2012 and 07 Mar 2014.

Additional information

- ▷ Language skills:

1. German (native speaker)
2. English (IELTS score of 8.0 in 2010, lived in the U.K. and the USA for 11 years)
3. Spanish (advanced level C.1)
4. French (advanced level 5 out of 6)

▷ Computing skills:

1. daily use: R, Python, \LaTeX
2. proficient: Java, Borland Delphi, SAGE, Matlab, Maple, MuPAD
3. other: C++, Singular, Pascal, Logo, text processing.

- ▷ Promoted to become a member of the German Physical Society DPG (*Deutsche Physikalische Gesellschaft*) in 2005 after having achieved the best Abitur result in physics at my high school.
- ▷ Lifelong member and *Scholar* (admitted as a Scholar in a ceremony on 01 Dec 2010 based on exam results) of Churchill College, University of Cambridge.
- ▷ Lifelong member of the International House community and residential member of the first International House in New York City (“i-house”) in 2015/6.
- ▷ Peer reviewer for the following journals: Biometrika, Computational Statistics and Data Analysis, Statistics and Probability Letters, Journal of Statistical Planning and Inference, Statistics, Estudios de Economia, Pattern Recognition Letters. Regular contributor to the AMS Mathematical Reviews.
- ▷ Member of the Royal Statistical Society of Great Britain (RSS) and attendee of various meetings in London.

Organised conferences

- ▷ *Young Statisticians’ Meeting YSM2013* at Imperial College London from 04–05 Jul 2013: Organiser (and head of the organising committee) of YSM, a yearly conference with around 100 participants from the United Kingdom and Europe. The invited guests included the current president and the immediate past-president of the Royal Statistical Society.

Selected contributed talks and posters

1. *9th International Conference on Computational Advances in Bio and Medical Sciences* in Miami, FL, from 15–17 Nov 2019.
2. *IEEE Intl Conference on Rebooting Computing 2019* in San Mateo, CA, from 06–08 Nov 2019.
3. *Joint Statistical Meeting JSM2019* in Denver, CO, from 27 Jul to 01 Aug 2019.
4. *International Conference on Computing Frontiers ACM 2019* in Alghero, Sardinia, Italy from 30 April to 02 May 2019.
5. *IEEE Intl Conference on Rebooting Computing 2017* in Washington, DC, from 06–07 Nov 2017.
6. *Joint Statistical Meeting JSM2017* in Baltimore, MD, from 29 Jul to 03 Aug 2017.
7. *10th International Conference on Multiple Comparison Procedures MCP2017* at the Uni-

versity of California in Riverside, CA, from 20–23 Jun 2017.

8. *Joint Statistical Meeting JSM2016* in Chicago, IL, from 30 Jul to 04 Aug 2016.
9. *Joint Statistical Meeting JSM2015* in Seattle, WA, from 08–13 Aug 2015.
10. *Joint Statistical Meeting JSM2014* in Boston, MA, from 02–07 Aug 2014.
11. *11th International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing (MCQMC2014)* in Leuven, Belgium, from 06–11 Apr 2014.
12. *German Probability and Statistics Days* in Ulm, Germany, from 04–07 Mar 2014.
13. *8th International Conference on Multiple Comparison Procedures MCP2013* at the University of Southampton, UK, from 09–11 Jul 2013.
14. *DAGStat2013* conference in Freiburg, Germany, from 18–23 Mar 2013.
15. *German Probability and Statistics Days* in Mainz, Germany, from 06–09 Mar 2012.
16. Presentation of my Part III essay topic *data compression* during the Students' Part III Seminar Series, Department of Mathematics, University of Cambridge, on 10 Mar 2010.

Teaching

1. Teaching at Imperial College London from 2011 to 2019:
 - ▷ Quarterly demonstration for various courses: M1M(Comp) Matlab, Civil Eng Year 1, Electrical Eng Year 2 Stats, M2S2 Statistical Modelling I, M1M(Comp) Maple, M1S Probability & Statistics I, M2S1 Probability & Statistics II, M4SC Scientific Computation.
 - ▷ Taught the two day course *LaTeX, R, and Sweave* for new masters students at Imperial College London on 06 and 07 Oct 2016.
 - ▷ Personal tutoring for SAT examinations while at Imperial College London in 2013 and personal tutoring for statistics courses while at Columbia University in 2015–16.
 - ▷ Lecturer of the course *M5MS11 Statistics for Extreme Events* in the Spring term of 2017. This course is a module in the statistics master programme of Imperial College London. Since I had full lecturing responsibilities I also ran weekly office hours, offered regular problem classes and problem sheet grading, set the exam, supervised the examination, graded all exam papers and approved the final marking scheme.
 - ▷ June 2016 to Spring 2019: Co-supervision of a Ph.D. student in the Mathematics Department of Imperial College London (of Professor Axel Gandy). My co-supervision included giving assistance and feedback on publication writing, cross-checking of proofs and help with paper submissions.
2. Teaching at the T.H. Chan School of Public Health of Harvard University from 2019–22:
 - ▷ Instructor of the course BST 234 (Introduction to Data Structures and Algorithms) together with Professor Christoph Lange from 2019–2021. BST 234 is one of the core courses in the Biostatistics Ph.D. program.

- ▷ Instructor of the course BST 262 (Computing for Big Data) since 2021. BST 262 is an auxiliary course for students across various departments.
- ▷ Instructor of the combined course BST 221+234 since 2022. The course covers both the requirement for the Ph.D. program, and serves as a course for Master level students.
- ▷ Member of the qualifying exam committee of the Biostatistics Department.