

Heng Guo

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<http://pages.cs.wisc.edu/~hguo/>

- Academic Experience**
- Google research fellow, Simons Institute, UC-Berkeley 2016/01 – 2016/05
 - Postdoctoral researcher, Queen Mary, University of London 2015/10 – present
Supervisor: Mark Jerrum
- Education**
- Ph.D. in *Computer Science* University of Wisconsin-Madison, 2015
Advisor: Jin-Yi Cai
Thesis: Complexity Classification of Exact and Approximate Counting Problems
 - M.A. in *Mathematics* University of Wisconsin-Madison, 2013
 - M.S. in *Computer Science* Peking University, 2010
 - B.S. in *Mathematics* Peking University, 2007
- Research Interests**
- Theoretical computer science, with an emphasis on computational counting and sampling.
- Honours and Awards**
- EATCS distinguished dissertation award. European Association for TCS, 2016.
 - Google research fellow. Simons Institute of Computing, UC-Berkeley, 2016 Spring.
 - Simons award for graduate students in TCS. The Simons foundation, 2013-2015.
 - Summer graduate research fellowship. University of Wisconsin-Madison, 2011.
 - Kang Zheng fellowship. Peking University, 2008-2009.
- Research Articles**
- Uniform Sampling through the Lovász Local Lemma
Heng Guo, Mark Jerrum, and Jingcheng Liu
STOC'17, to appear
Available at <http://arxiv.org/abs/1611.01647>
 - The Complexity of Approximating Complex-Valued Ising and Tutte Partition Functions
Leslie Ann Goldberg and Heng Guo
Comput. Complex., accepted
Available at <http://arxiv.org/abs/1409.5627>
 - Random Cluster Dynamics for the Ising Model is Rapidly Mixing
Heng Guo and Mark Jerrum
SODA'17, pp. 1818-1827
 - Uniqueness, Spatial Mixing, and Approximation in Ferromagnetic 2-Spin Systems
Heng Guo and Pinyan Lu
RANDOM'16, 31:1-26

- Approximation via Correlation Decay when Strong Spatial Mixing Fails
Ivona Bezáková, Andreas Galanis, Leslie Ann Goldberg, Heng Guo, and Daniel Štefankovič
ICALP'16, 45:1-13
- A Holant Dichotomy: Is the FKT Algorithm Universal?
Jin-Yi Cai, Zhiguo Fu, Heng Guo, and Tyson Williams
FOCS'15, pp. 1259-1276
- The Complexity of Counting Edge Colorings and a Dichotomy for Some Higher Domain Holant Problems
Jin-Yi Cai, Heng Guo, and Tyson Williams
Res. Math. Sci., 3:18, 2016
Preliminary version: **FOCS'14**, pp. 601-610
- #BIS-Hardness for 2-Spin Systems on Bipartite Bounded Degree Graphs in the Tree Nonuniqueness Region
Jin-Yi Cai, Andreas Galanis, Leslie Ann Goldberg, Heng Guo, Mark Jerrum, Daniel Štefankovič, and Eric Vigoda
J. Comput. Syst. Sci., 82(5), 690-711, 2016
Preliminary version: **RANDOM'14**, pp. 582-595
- Holographic Algorithms Beyond Matchgates
Jin-Yi Cai, Heng Guo, and Tyson Williams
ICALP'14, pp. 271-282
- The Complexity of Planar Boolean #CSP with Complex Weights
Heng Guo and Tyson Williams
ICALP'13, pp. 516-527
- A Complete Dichotomy Rises from the Capture of Vanishing Signatures
Jin-Yi Cai, Heng Guo, and Tyson Williams
SIAM J. Comput., 45(5), 1671-1728, 2016
Preliminary version: **STOC'13**, pp. 635-644
- Inapproximability After Uniqueness Phase Transition in Two-Spin Systems
Jin-Yi Cai, Xi Chen, Heng Guo, and Pinyan Lu
COCOA'12, pp. 336-347
- The Complexity of Symmetric Boolean Parity Holant Problems
Heng Guo, Pinyan Lu, and Leslie G. Valiant
SIAM J. Comput., 42(1), 324-356, 2013
Preliminary version: **ICALP'11**, pp. 712-723
- The Complexity of Weighted Boolean #CSP Modulo k
Heng Guo, Sangxia Huang, Pinyan Lu, and Mingji Xia
STACS'11, pp. 249-260
- On Model Checking Boolean BI
Heng Guo, Hanpin Wang, Zhongyuan Xu and Yongzhi Cao
CSL'09, pp. 302-316

**Book Chapters,
Surveys,
Other Writings**

- Mapping the Complexity of Counting Problems
Heng Guo
Bulletin of EATCS, No 120: October 2016
- On the Complexity of Holant Problems
Heng Guo and Pinyan Lu
Dagstuhl Follow-Ups, in press
- Holant Problems
Jin-Yi Cai, Heng Guo, and Tyson Williams
Encyclopedia of Algorithms 2016: 918-921

Talks

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|------|-----|---|
| 2017 | Jan | Random cluster dynamics for the Ising model is rapidly mixing
SODA 2017, Barcelona, Spain |
| 2016 | Dec | Uniform sampling through the Lovász Local Lemma
Nanjing University, China |
| | Dec | Uniform sampling through the Lovász Local Lemma
ITCS Workshop I, Shanghai University of Finance and Economics, China |
| | Nov | Random cluster dynamics for the Ising model is rapidly mixing
Oxford University, UK |
| | Oct | Random cluster dynamics for the Ising model is rapidly mixing
Queen Mary, University of London, UK |
| | Sep | Uniqueness, spatial mixing, and approximation in ferromagnetic 2-Spin Systems
RANDOM 2016, Paris, France |
| | Jul | Approximation via correlation decay when strong spatial mixing Fails
ICALP 2016, Rome, Italy |
| | Jun | Random cluster dynamics for the Ising model is rapidly mixing
Shanghai University of Finance and Economics, China |
| | May | Random cluster dynamics for the Ising model is rapidly mixing
Harvard University, MA |
| | Apr | Random cluster dynamics at $q = 2$ is rapidly mixing
Counting program seminar, Simons Institute, UC-Berkeley, CA |
| | Mar | Approximating 2-state spin systems
Classification workshop, Simons Institute, UC-Berkeley, CA |
| | Jan | Planar dichotomy theorems
Counting program bootcamp, Simons Institute, UC-Berkeley, CA |
| 2015 | Oct | Uniqueness, spatial mixing, and approximate counting
Columbia University, NY |
| | Oct | A Holant dichotomy: is the FKT algorithm universal?
FOCS 2015, Berkeley, CA |
| 2014 | Dec | The complexity of Ising models with complex weights
Midwest Theory Day, University of Michigan, MI |

- Sep Dichotomy theorems in computational complexity
Nanjing University, Nanjing, China
- Sep Edge coloring, Siegel's theorem, and a Holant dichotomy
China Theory Week, Tsinghua University, Beijing, China
- Sep #BIS-hardness for 2-spin systems on bipartite bounded degree graphs in the tree nonuniqueness region
RANDOM 2014, Barcelona, Spain
- Jul Holographic algorithms beyond matchgates
ICALP 2014, Copenhagen, Denmark
- May Phase transition and computational transition
Oxford University, UK
- Feb Complexity dichotomies for counting problems
Durham University, UK
- 2013 Jul The complexity of planar Boolean #CSP with complex weights
ICALP 2013, Riga, Latvia
- Jun A complete dichotomy rises from the capture of vanishing signatures
STOC 2013, Palo Alto, CA
- Jan A complete dichotomy rises from the capture of vanishing signatures
Dagstuhl Seminar on Computational Counting, Germany

Teaching Experiences

- Lecturer in Queen Mary, University of London:
 - 2016 Fall MTH742P (Advanced Combinatorics)
- Teaching Assistant in the University of Wisconsin Madison:
 - 2013 Fall CS520 (Introduction to Theoretical Computer Science)
 - 2011 Fall CS577 (Introduction to Algorithms)
 - 2011 Spring CS302 (Introduction to Computation)
 - 2010 Fall CS202 (Introduction to Programming)
- Teaching Assistant in Peking University:
 - 2009 Spring Mathematical Logic
 - 2008 Fall Concurrency Theory
 - 2008 Fall Number Theory
 - 2008 Spring Mathematical Logic
 - 2007 Fall Probability and Statistics

Services

- Seminar organizer of the 2016 spring program “Counting Complexity and Phase Transitions” in the Simons institute of UC-Berkeley.
- Journal Reviews: SIAM Journal on Computing,
Journal of Computer and System Sciences,
Computational Complexity,
Information and Computation,
Theoretical Computer Science,
Theory of Computing,
ACM Transactions on Computation Theory,
Theory of Computing Systems,
Journal of Discrete Algorithms.
- Conference Reviews: ESA, FAW, FOCS, ICALP, ISAAC, MFCS, SODA, STACS, TAMC.
- Other Reviews: MathSciNet, Handbook of the Tutte Polynomial.