

Alexander S. Wein

CONTACT INFORMATION	Simons Institute for the Theory of Computing UC Berkeley Office: Melvin Calvin Laboratory, Room 318	awein@berkeley.edu www.alex-wein.com
RESEARCH INTERESTS	Theoretical computer science, mathematics of data science, statistics	
APPOINTMENTS	Simons Institute for the Theory of Computing, UC Berkeley <i>Simons-Berkeley Research Fellow</i> , Fall 2021 Courant Institute, Department of Mathematics, New York University <i>Assistant Professor/Courant Instructor</i> , Fall 2018 – Spring 2021 With half-time postdoctoral position sponsored by: <ul style="list-style-type: none">• Afonso Bandeira, and• the Simons Collaboration on Algorithms and Geometry	
EDUCATION	Massachusetts Institute of Technology Ph.D. in Mathematics, June 2018 <ul style="list-style-type: none">• Advisor: Ankur Moitra• Thesis: <i>Statistical Estimation in the Presence of Group Actions</i> California Institute of Technology B.S. in Computer Science and Mathematics (with honors), June 2013 <ul style="list-style-type: none">• Class rank: 4 of 243; 1 of 34 in Computer Science	
HONORS/AWARDS	Charles W. and Jennifer C. Johnson Prize, MIT Department of Mathematics, 2018 <i>Awarded to a current graduate student in recognition of an outstanding mathematics paper accepted for publication in a major journal</i> , for paper “Optimality and Sub-optimality of PCA I: Spiked Random Matrix Models” published in the Annals of Statistics National Defense Science and Engineering Graduate Fellowship, 2014 – 2017	
GRANTS	NSF DMS Award Number 1712730 <i>Collaborative Research: Statistical Estimation with Algebraic Structure</i> Role: Principal Investigator, 2019 – 2021 (Took over for Afonso Bandeira as the PI when he left the United States)	
SURVEY ARTICLES	Notes on Computational Hardness of Hypothesis Testing: Predictions using the Low-Degree Likelihood Ratio Dmitriy Kunisky, Alexander S. Wein, Afonso S. Bandeira <i>arXiv:1907.11636</i> , 2019 Notes on Computational-to-Statistical Gaps: Predictions using Statistical Physics Afonso S. Bandeira, Amelia Perry, Alexander S. Wein <i>Portugaliae Mathematica</i> , 2018	

Average-Case Integrality Gap for Non-Negative Principal Component Analysis

Afonso S. Bandeira, Dmitriy Kunisky, Alexander S. Wein
Mathematical and Scientific Machine Learning (MSML), 2021

Optimal Low-Degree Hardness of Maximum Independent Set

Alexander S. Wein
Mathematical Statistics and Learning (to appear)

Spectral Planting and the Hardness of Refuting Cuts, Colorability, and Communities in Random Graphs

Afonso S. Bandeira, Jess Banks, Dmitriy Kunisky, Cristopher Moore, Alexander S. Wein
Conference on Learning Theory (COLT), 2021

Free Energy Wells and Overlap Gap Property in Sparse PCA

G rard Ben Arous, Alexander S. Wein, Ilias Zadik
Conference on Learning Theory (COLT), 2020

The Average-Case Time Complexity of Certifying the Restricted Isometry Property

Yunzi Ding, Dmitriy Kunisky, Alexander S. Wein, Afonso S. Bandeira
IEEE Transactions on Information Theory, 2021

Low-Degree Hardness of Random Optimization Problems

David Gamarnik, Aukosh Jagannath, Alexander S. Wein
Symposium on Foundations of Computer Science (FOCS), 2020

Counterexamples to the Low-Degree Conjecture

Justin Holmgren, Alexander S. Wein
Innovations in Theoretical Computer Science (ITCS), 2021

The Kikuchi Hierarchy and Tensor PCA

Alexander S. Wein, Ahmed El Alaoui, Cristopher Moore
Symposium on Foundations of Computer Science (FOCS), 2019

Computational Hardness of Certifying Bounds on Constrained PCA Problems

Afonso S. Bandeira, Dmitriy Kunisky, Alexander S. Wein
Innovations in Theoretical Computer Science (ITCS), 2020

Overcomplete Independent Component Analysis via SDP

Anastasia Podosinnikova, Amelia Perry, Alexander S. Wein, Francis Bach, Alexandre d'Aspremont, David Sontag
International Conference on Artificial Intelligence and Statistics (AISTATS), 2019

Spectral Methods from Tensor Networks

Ankur Moitra, Alexander S. Wein
Symposium on Theory of Computing (STOC), 2019; invited to *SICOMP special issue*

Statistical Limits of Spiked Tensor Models

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira
Annales de l'Institut Henri Poincar e (B) Probability and Statistics, 2020

Message-Passing Algorithms for Synchronization Problems over Compact Groups

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, Ankur Moitra
Communications on Pure and Applied Mathematics, 2018

Optimality and Sub-optimality of PCA I: Spiked Random Matrix Models

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, Ankur Moitra
Annals of Statistics, 2018

How Robust are Reconstruction Thresholds for Community Detection?

Ankur Moitra, Amelia Perry, Alexander S. Wein
Symposium on Theory of Computing (STOC), 2016

A Semidefinite Program for Unbalanced Multisection in the Stochastic Block Model

Amelia Perry, Alexander S. Wein
International Conference on Sampling Theory and Applications (SampTA), 2017

PREPRINTS

Circuit Lower Bounds for the p-Spin Optimization Problem

David Gamarnik, Aukosh Jagannath, Alexander S. Wein
arXiv:2109.01342, 2021

Optimal Spectral Recovery of a Planted Vector in a Subspace

Cheng Mao, Alexander S. Wein
arXiv:2105.15081, 2021

Computational Barriers to Estimation from Low-Degree Polynomials

Tselil Schramm, Alexander S. Wein
arXiv:2008.02269, 2020

Computationally Efficient Sparse Clustering

Matthias Löffler, Alexander S. Wein, Afonso S. Bandeira
arXiv:2005.10817, 2020

Subexponential-Time Algorithms for Sparse PCA

Yunzi Ding, Dmitriy Kunisky, Alexander S. Wein, Afonso S. Bandeira
arXiv:1907.11635, 2019

Estimation Under Group Actions: Recovering Orbits from Invariants

Afonso S. Bandeira, Ben Blum-Smith, Joe Kileel, Amelia Perry, Jonathan Weed, Alexander S. Wein
arXiv:1712.10163, 2017

Optimality and Sub-optimality of PCA for Spiked Random Matrices and Synchronization

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, Ankur Moitra
arXiv:1609.05573, 2016

INVITED TALKS

Statistical Estimation of Orbits from Invariants

Mini-symposium on Applied Invariant Theory, SIAM Conference on Applied Algebraic Geometry, Aug. 2021

Low-Degree Hardness of Maximum Independent Set
Workshop on Random Graphs and Statistical Inference, BIRS, Aug. 2021

Optimal Spectral Recovery of a Planted Vector in a Subspace
One World MINDS Seminar, Aug. 2021

Computational Barriers to Estimation from Low-Degree Polynomials
Mini-symposium on Low-Rank Models and Applications, Fields Institute, June 2021

The Kikuchi Hierarchy and Tensor PCA
Workshop on Mathematical Foundations and Algorithms for Tensor Computations, IPAM, May 2021

Low-Degree Hardness of Random Optimization Problems
Workshop on Learning and Testing in High Dimensions, Simons Institute, Dec. 2020

Lecture Series on the Low-Degree Polynomial Method
Simons Institute, Oct.–Nov. 2020

Computational Barriers to Estimation from Low-Degree Polynomials
Young Data Science Researcher Seminar, ETH Zurich, Oct. 2020

Computational Barriers to Estimation from Low-Degree Polynomials
ISL Colloquium, Stanford, Oct. 2020

Low-Degree Hardness of Random Optimization Problems
TCS+, Sept. 2020

Pedagogical Talk on the Low-Degree Method
Workshop on Computational Phase Transitions, Simons Institute, Sept. 2020

Spectral Methods from Tensor Networks
Mini-symposium on Recent Advances in the Method of Moments, SIAM Conference on Mathematics of Data Science, June 2020

Understanding Statistical-vs-Computational Tradeoffs via the Low-Degree Likelihood Ratio
MIFODS Workshop on Learning under Complex Structure, MIT, Jan. 2020

Understanding Statistical-vs-Computational Tradeoffs via the Low-Degree Likelihood Ratio
WORDS Conference, Fuqua School of Business, Duke University, Dec. 2019

Understanding Statistical-vs-Computational Tradeoffs via the Low-Degree Likelihood Ratio
Computer Science Theory Seminar, UIC, Nov. 2019

Understanding Statistical-vs-Computational Tradeoffs via the Low-Degree Likelihood Ratio
Stochastics Seminar, Georgia Tech, Oct. 2019

The Kikuchi Hierarchy and Tensor PCA
Allerton Conference, Sept. 2019

The Kikuchi Hierarchy and Tensor PCA
MIFODS Workshop on Graphical Models, MIT, Aug. 2019

Hardness of Certification for Constrained PCA Problems
IDeAS Seminar, Princeton, Apr. 2019

Estimation in the Presence of Group Actions
Workshop on Combinatorial Statistics, Universite de Montreal, Apr.–May 2018

Computational Invariant Theory and Multi-Reference Alignment over General Groups
Simons Collaboration on Algorithms & Geometry, New York, NY, Nov. 2017

Message Passing Algorithms for Cryo-EM and Synchronization
Broad Institute, Cambridge, MA, Nov. 2017

Optimality and Sub-optimality of PCA for Spiked Random Matrix Models
Algorithms and Complexity Seminar, MIT, Oct. 2016

How Robust are Reconstruction Thresholds for Community Detection?
IDeAS Seminar, Princeton, May 2016

TEACHING
EXPERIENCE

Courant Institute, New York University

Spring 2021 *Discrete Mathematics*
Instructor

Fall 2019 *Calculus 1*
Instructor

Fall 2018 *Calculus 1*
Instructor

SERVICE

Reviewed papers for conferences: STOC 2015, FOCS 2017, RANDOM 2017, NeurIPS 2017, STOC 2018, ICML 2018, COLT 2018, NeurIPS 2018, SODA 2019, ICML 2019, COLT 2019, ISIT 2019, STOC 2020, ISIT 2020, FOCS 2020, STOC 2021, ESA 2021, RANDOM 2021, FOCS 2021, NeurIPS 2021

Reviewed papers for journals: Comm. Pure Appl. Math; IEEE Trans. Inf. Theory; IEEE Signal Process. Lett.; Ann. Appl. Probab.; Bernoulli; Found. Comput. Math.; Math. Stat. Learn.; Ann. Probab.; Ann. Statist.; Phys. Rev. E; SIAM J. Comput; JSAIT; Inf. Inference; Phys. Rev. Research; J. R. Stat. Soc. Ser. B. Stat. Methodol.; Phys. A

Organized MIT applied math graduate student seminar (SPAMS), 2014 – 2015