Amelia **Perry**

PhD Candidate

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Research interests

I design algorithms to analyze very noisy data, working at the interface of machine learning, optimization, statistical physics, and algebra. My work centers a family of noisy geometric problems arising in structural biology (cryo-EM), robotics, image processing, signals processing, and community detection in networks. I am excited to build on my work on cryo-EM by immersing myself in the life sciences and bringing data science to bear on meaningful scientific problems.

Education

Ph.D., Massachusetts Institute of Technology (expected) — *Cambridge, MA*

in Applied Mathematics — *Sep 2013–Jun 2018*

- Advised by Ankur Moitra, and co-advised by Jon Kelner.
- Thesis: *Inference with group structure: message-passing algorithms and invariant theory.*

MMath, University of Oxford — *Oxford, UK*

in Mathematics — *Oct 2009–Jun 2013*

- First class honors in both the BA-equivalent and Master's parts.
- Advised by Christopher Douglas.
- Thesis: *Spin two-dimensional local field theories.*

Publications

The sample complexity of multi-reference alignment.

Amelia Perry, Jonathan Weed, Afonso S. Bandeira, Philippe Rigollet, and Amit Singer — *2017*

- Under review; available at arxiv.org/abs/1707.00943.

Statistical limits of spiked tensor models.

Amelia Perry, Alexander S. Wein, and Afonso S. Bandeira — *2016*

- Under review; available at arxiv.org/abs/1612.07728.

Message-passing algorithms for synchronization problems over compact groups.

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, and Ankur Moitra — *2016*

- To appear in Communications on Pure and Applied Mathematics.

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

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, and Ankur Moitra — *2016*

- To appear in Annals of Statistics.

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

Amelia Perry, Alexander S. Wein, Afonso S. Bandeira, and Ankur Moitra — *2016*

- Preprint, available at arxiv.org/abs/1609.05573.

How Robust are Reconstruction Thresholds for Community Detection?

Ankur Moitra, William Perry, and Alexander S. Wein — *2015*

- In Proceedings of the 48th annual ACM Symposium on the Theory of Computing (STOC 2016).

A semidefinite program for unbalanced multisection in the stochastic block model.

Amelia Perry and Alexander S. Wein — *2015*

- In 2017 International Conference on Sampling Theory and Applications (SampTA 2017).

Spin two-dimensional local field theories.

William Perry *2013*

- MMath thesis, University of Oxford.

Honors

2013 **Best Mathematics Student**, SET Awards Europe
2013 **Dissertation Prize**, Mathematical Institute, University of Oxford
2013 **Honorable Mention**, NSF Graduate Research Fellowship
2010–2013 **Scholarship**, Keble College, Oxford

Talks

Unbalanced multisection in the stochastic block model.

- Sampling Theory and Applications (SAMPTA 2017), Jul 2017.

Computational to statistical gaps: predictions using statistical physics.

- Workshop on "Connecting communities via the block model", American Institute for Mathematics, May 2017.
- Special lecture series at Courant Institute, New York University, May 2017.

Optimality and sub-optimality of principal component analysis for spiked random matrices.

- Probability seminar, Courant Instute, Nov 2016.

Message-passing algorithms for synchronization problems.

- *(poster)* New England Machine Learning Day, May 2017.
- Workshop on "Optimization and Statistical Learning", École Physique des Houches, Apr 2017.
- *(poster)* Workshop on "Statistical Physics, Learning, Inference, and Networks", École Physique des Houches, Feb 2017.
- LIDS Student Conference, MIT, Feb 2017.
- Simple Person's Applied Math Seminar, MIT, Sep 2016.
- IDEAS seminar, Princeton University, May 2016.

Statistical lower bounds for synchronization problems.

- Simple Person's Applied Math Seminar, MIT, Apr 2016

Models, algorithms, and lower bounds for community detection.

- Theory Lunch, MIT EECS, Feb 2016
- Simple Person's Applied Math Seminar, MIT, Sep 2015

Symmetric monoidal (∞,1)-categories and the stable motivic (∞,1)-category

- Talbot Workshop, Mar 2014
- Juvitop seminar, MIT, Feb 2014

Software

SumOfSquaresOptimization.jl

Julia package for solving convex sum-of-squares relaxations of polynomial problems. *Feb 2015*

- Available at github.com/ameliaperry/SumOfSquaresOptimization.jl.

bpcobar

Small Java tool for computing in the cobar complex for BP_*BP. *May 2014*

- Available at github.com/ameliaperry/bpcobar.

resolution

Java software for computing and visualizing E_2 terms of various spectral sequences. *Nov 2013*

- Available at github.com/ameliaperry/resolution.
- Used by several topologists for both research and pedagogy.

Service

Teaching

Spring '16	**Teaching assistant**, 18.03 Differential Equations	*MIT*
Fall '15	**Grader**, 18.657 Mathematics of Machine Learning	*MIT*
Spring '15	**Grader**, 18.330 Introduction to Numerical Analysis	*MIT*
Fall '14	**Teaching assistant**, 6.042 Mathematics for Computer Scientists	*MIT*
'12 & '13	**Head Counselor**, Program in Mathematics for Young Scientists (PROMYS), six week summer program	*Boston University*
'11	**Counselor**, Program in Mathematics for Young Scientists (PROMYS), six week summer program	*Boston University*

Mentoring

2016	**Mentor**, Summer Program in Undergraduate Research (SPUR), six week summer project	*MIT*
2016	**Mentor**, Undergraduate Research Opportunity (UROP), three month summer project	*MIT*
Jan '16	**Mentor**, Directed Reading Program (DRP)	*MIT*
Jan '14	**Mentor**, Directed Reading Program (DRP)	*MIT*

Reviewing

Conference reviewer, RANDOM 2017, NIPS 2017, SampTA 2017, ISIT 2017, STOC 2017, SODA 2017

Journal reviewer, Communications in Pure and Applied Mathematics, IEEE Transactions on Information Theory, Annals of Statistics

Organization

Feb 2017	**Event organizer**, Diversity event at MIT Mathematics with LBGT@MIT	*MIT*
2015–2016	**Seminar organizer**, Simple Person's Applied Math Seminar	*MIT*

REFERENCES

Ankur Moitra (moitra@mit.edu)

Rockwell International Career Development Associate Professor, Massachusetts Institute of Technology

Philippe Rigollet (rigollet@math.mit.edu)

Associate Professor, Massachusetts Institute of Technology

Afonso Bandeira (bandeira@cims.nyu.edu)

Assistant Professor, New York University