Kimmel, Shelby

skimmel@middlebury.edu • 617-549-5732

Middlebury College, Bicentennial Hall, 635

Middlebury, Vermont 05753

Website: www.shelbykimmel.com

Education

2009-2014	**Massachusetts Institute of Technology,** Cambridge, MA Ph.D. in Physics. Advised by Edward Farhi. Thesis Title: Cumulative Effects in Quantum Algorithms and Quantum Process Tomography
2004-2008	**Williams College**, Williamstown, MA B.A. in Astrophysics. Advised by William Wootters. GPA 3.96/4.0 Thesis Title: Quantifying the Entanglement Cost of Nonlocal Measurements

Research Interests

I design and analyze quantum algorithms, which take advantage of the laws governing small physical systems in order to solve computational problems. I also create efficient and accurate ways of characterizing errors in quantum devices, helping experimentalists to build the first generation of quantum computers. I sometimes think about quantum complexity theory and quantum information theory.

Positions

2017-present	**Middlebury College,** *Middlebury, VT* Visiting Assistant Professor of Computer Science
2014-2017	**University of Maryland,** *College Park, MD* Hartree Postdoctoral Fellow at the Joint Center for Quantum Information and Computer Science (QuICS)
2009-2014	**Massachusetts Institute for Technology,** *Cambridge, MA* Research Assistant, Center for Theoretical Physics Advised by Edward Farhi
2012, 2013, Summers	**Raytheon BBN Technologies,** *Cambridge, MA* Graduate Intern with the Quantum Information Processing Group Advised by Marcus P. da Silva
2011, Summer	**University of Waterloo,** *Waterloo, ON* Research Assistant, Institute for Quantum Computing Advised by Andrew Childs
2008-2009	**Gochang-Buk High School,** Gochang, Jeollabuk-do, South Korea Fulbright English Teaching Assistant

Teaching Experience

2017-present	**Middlebury College,** *Middlebury, VT* • Algorithms and Complexity (CSCI 302), Fall 2017 • Math Foundations of Computer Science (CSCI 200), Fall 2017

2016	**University of Maryland,** *College Park, MD*

- Discussion Section Instructor, Object Oriented Programming I (CMSC 131), Fall 2016. Taught 40 students for 2 hr/wk, using a mix of short lectures, small group activities, and coding exercises.
- Guest Lecturer, Object Oriented Programming I (CMSC 131), Fall 2016
- Co-Teacher, Introduction to Quantum Information Processing (CMSC 858K), Fall 2016. Taught 4 week of classes.

2010-2014	**Massachusetts Institute of Technology,** *Cambridge, MA*

- Teaching Assistant, Introduction to Electricity and Magnetism (8.02), Spring 2011. Assisted with active learning activities during class.
- Writing Teaching Assistant, Quantum Mechanics III (8.06), Spring 2012, 2014. Guided students through the process of writing a research report.
- Graduate Teaching Certificate Program, 2010-2011. Learned various pedagogical approaches.

2010-2013	**Tutoring Plus,** *Cambridge, MA*

- Middle School Tutor. Tutored students from economically disadvantaged backgrounds in math and writing.

2008-2009	**Gochang-Buk High School,** *Gochang, Jeollabuk-do, South Korea*

- Conversational English Instructor

2005-2008	**Williams College,** *Williamstown, MA*

- Writing Tutor. Worked with my peers (across disciplines) to edit and improve their writing.

Mentorship and Leadership

2014-2016	**University of Maryland,** *College Park, MD*

- Mentored undergraduate and graduate women through the UMD Women in Physics Mentoring Program

2009-2014	**Massachusetts Institute of Technology,** *Cambridge, MA*

- Organized graduate/undergraduate women in physics mentoring program
- Mentored undergraduate women each year of graduate school
- Planned a networking seminar for women in physics (2012)
- Coordinated Graduate Women at MIT (GWAMIT) mentoring program. Helped to recruit 200 alumni, professors, and graduate students to the program, matched participants through surveys, managed a committee of 8 people, and planned bi-yearly dinners.
- Organized Online Personal Branding event at the GWAMIT Empowerment Conference (2010)

Advising

2017	Will Kirby (Williams College, '17), Improvements to Robust Phase Estimation
2016	Andrew Zhao (University of Maryland, Physics, '19), Phase estimation using anisotropic compressed sensing.

2016	Mark Hubbert (University of Maryland, Physics, '19), Single qubit calibration with experimentally motived cost
2015	Hardik Bansal (IIT Kanpur, Computer Science, '17), Distinguishing Non-local Entanglement

Awards

2014	Hartree Postdoctoral Fellow, QuICS
2013	Graduate Women of Excellence Award (1 of 50), MIT
2012	Best Student Paper Track A (1 of 2), ICALP (For "Quantum Adversary (Upper) Bound.")
2012	Best Scientific Poster (1 of 2), QIP (For "The Quantum Query Complexity of Read-Many Formulas.")
2011	Best Talk (1 of 3), Women in Physics Canada (For "Super-polynomial Quantum Speed-ups in Boolean Formulas.")
2009	American Physical Society Apker Award Finalist (national award for undergraduate research; 1 of 3)

Professional Service

- **Co-organizer,** Workshop on QMA(2) and the Complexity of Entanglement, 2016, University of Maryland, College Park, MD

- **Program Committee Member,** Quantum Information Processing (QIP) 2018, Theory of Quantum Computing (TQC) 2017, Asian Quantum Information Science (AQIS) 2016

- **Journal Referee,** Theory of Computing, Nature Communications, Quantum (http://quantum-journal.org/), Quantum Information and Computation, International Journal of Quantum Information

- **Conference Referee,** STOC, FOCS, SODA, ESA, QIP, TQC

- **Sorter,** American Physical Society March Meeting

Selected Invited Talks (For a more complete list, see my website)

2017	University of Austin. Austin, TX. Computer Science Colloquium. "Path Detection: A Quantum Computing Primitive."
2017	Last Frontiers in Quantum Information Workshop. Seward, AK. "Path Detection: A Quantum Computing Primitive."
2016	University of Copenhagen QMATH Center Kick-Off Conference. Copenhagen, Denmark. "What does the effective resistance of electrical circuits have to do with quantum algorithms?"
2016	Schrodinger Sessions (a workshop to introduce quantum mechanics to science fiction writers). College Park, MD. "Quantum Algorithms."
2015	Sandia National Labs. Albuquerque, NM. "Robust Phase Estimation with Applications to Single-Qubit Process Characterization."

2014   Williams College. Williamstown, MA. Women in physics colloquium. "Problems with Multiple Oracles."

2014   APS March Meeting. Denver, CO. "Randomized Benchmarking Tomography."

2013   Coogee Quantum Information Conference. Sydney, AU. "Problems with Multiple Oracles."

2013   Isaac Newton Institute. Cambridge, UK. Mathematical Challenges in Quantum Information Workshop. "Robust Characterization of Quantum Processes."

2013   Perimeter Institute. Waterloo, Canada. "The Quantum Adversary (Upper) Bound."

Publications

Depending on the topic of the research, I publish in both computer science conference proceedings and in physics journals. Physics journals are more prestigious than physics conference proceedings. Additionally, in physics papers, author order is often important; generally, the first author is the lead author.

- S. Jeffery. **S. Kimmel.** Quantum Algorithms for Graph Connectivity and Formula Evaluation. *Quantum* vol. 26, 2017.

- K. Rudinger, **S. Kimmel**, D. Lobser, P. Maunz. Experimental demonstration of cheap and accurate phase estimation. *Physical Review Letters* 118 (19), 190502. 2017.

- **S. Kimmel**, C. Y. Y. Lin, G. H. Low, M. Ozols, T. J. Yoder. Hamiltonian Simulation with Optimal Sample Complexity. *Nature Partner Journals Quantum Information*, vol 3, no 13, 2017.

- **S. Kimmel,** Y.-K. Liu. Quantum Compressed Sensing Using 2-Designs. *Proceedings of SAMPTA* 2017, pp 345-349.

- E. Farhi, **S. Kimmel,** K. Temme. A Quantum Version of Schöning's Algorithm Applied to Quantum 2-SAT. *Quantum Information and Computation.* Vol 16, no 13-14. 2016. pp1212-1227.

- B. Fefferman, **S. Kimmel.** Quantum vs Classical Proofs and Subset Verification. Arxiv:1510.06750. 2015.

- **S. Kimmel,** C. Y. Y. Lin, H. H. Lin. Oracles with Costs. *Proceedings of Theory of Quantum Computing 2015.* pp 1-26.

- B. R. Johnson, M. P. da Silva, C. A. Ryan, **S. Kimmel**, J. M. Chow, T. A. Ohki. Demonstration of Robust Quantum Gate Tomography via Randomized Benchmarking. New Journal of Physics 17 (11), 113019. 2015.

- **S. Kimmel,** G. H. Low, T. J. Yoder. Robust calibration of a universal single-qubit gate set via robust phase estimation. *Phys. Rev. A* 92 (6), 062315. 2015

- **S. Kimmel,** M. P. da Silva, C. Ryan, B. Johnson, T, Ohki. Robust Extraction of Tomographic Information via Randomized Benchmarking. In *Physical Review X,* 2014, vol 4, n 1, pp 011050.

- A. M. Childs, **S. Kimmel**, R. Kothari. The Quantum Query Complexity of Read-Many Formulas. *Proceedings of ESA 2013*, pp 337-348.

- **S. Kimmel.** Quantum Adversary (Upper) Bound. *Chicago Journal of Theoretical Computer Science*, vol 2013 n 4. And *Proceedings of ICALP.* 2012 pp 557-568.

- B. Zhan, **S. Kimmel**, A. Hassidim. Super-polynomial Quantum Speed-ups for Boolean Evaluation Trees with Hidden Structure. *Proceedings of ITCS*, pp 249-265. 2012

- S. Bandyopadhyay, G. Brassard, **S. Kimmel**, W. Wootters. Entanglement Cost of Nonlocal Measurements. *Phys. Rev. A.* vol 80, n 1, pp 012313, 2009.

- J. Pasachoff, **S. Kimmel**, M. Druckmuller, V. Rusin, M. Saniga. The April 8, 2005 Eclipse White-light Corona. *Solar Physics*. vol 238, n 2, pp 261-270, 2006

.