

Henry Yuen

Assistant Professor of Computer Science
Columbia University

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Areas of specialization

Quantum computing, quantum information theory, cryptography, complexity theory.

Appointments held

- 2021 – Assistant Professor, Columbia University
Department of Computer Science
- 2018 – Assistant Professor, University of Toronto (*on leave*)
Departments of Computer Science and Mathematics (*joint appointment*)
- 2016 – 2018 Postdoctoral Associate in Computer Science, University of California, Berkeley

Education

- 2011 – 2016 Ph.D. in Computer Science, MIT
Thesis supervisor: Dana Moshkovitz
Thesis title: *Games, Protocols, and Quantum Entanglement*
- 2006 – 2010 B.A. in Mathematics, University of Southern California

Grants

- 2020 – 2023 Air Force Office of Scientific Research Grant (USD 390,000)
- 2019 Google Quantum Research Award (USD 100,000)
co-PI: Juan Carrasquilla.
- 2019 – 2024 NSERC Discovery Grant (CAD 115,000)

Honors & Awards

- 2020 Simons-Berkeley Research Fellowship.
- 2017 “Multiplayer parallel repetition for expander games” designated Invited Talk at *Innovations in Theoretical Computer Science (ITCS) 2017*.
- 2016 “Anchoring games for parallel repetition” invited as a Plenary Talk at *Quantum Information Processing (QIP) 2016*.

2015 – 2017 Simons Graduate Fellowship for Theoretical Computer Science
2012 – 2015 NSF Graduate Fellowship
2011 MIT Presidential Fellowship

Publications

Preprints

- 2020 Rigidity of superdense coding.
Ashwin Nayak, Henry Yuen.
Submitted.
Available at <https://arxiv.org/abs/2012.01672>
- Quantum Garbled Circuits.
Zvika Brakerski, Henry Yuen.
To be presented at *Quantum Information Processing (QIP) 2021*.
Available at <https://arxiv.org/abs/2006.01085>
- Quantum statistical query learning.
Srinivasan Arunachalam, Alex B. Grilo, Henry Yuen.
Submitted.
Available at <https://arxiv.org/abs/2002.08240>
- MIP* = RE.
Zhengfeng Ji, Anand Natarajan, Thomas Vidick, John Wright, Henry Yuen.
Submitted.
Available at <https://arxiv.org/abs/2001.04383>

Conference proceedings

- 2020 On the complexity of zero gap MIP*.
Hamoon Mousavi, Seyed Sajjad Nezhadi, Henry Yuen.
Presented at *TQC 2020*.
In proceedings of *Int'l Coll. on Automata, Languages, and Programming (ICALP) 2020*.
- 2019 Perfect zero knowledge for quantum multiprover interactive proofs.
Alex B. Grilo, William Slofstra, Henry Yuen.
Presented at *QCRYPT 2019*.
Presented at *Quantum Information Processing (QIP) 2020*.
In proceedings of *Foundations of Computer Science (FOCS) 2019*.
- Good approximate quantum LDPC codes from spacetime circuit Hamiltonians.
Thomas C. Bohdanowicz, Elizabeth Crosson, Chinmay Nirkhe, Henry Yuen.
Presented at *Quantum Information Processing (QIP) 2019*.

In proceedings of *Symposium on Theory of Computing (STOC) 2019*.

Quantum proof systems for iterated exponential time, and beyond.

Joseph Fitzsimons, Zhengfeng Ji, Thomas Vidick, Henry Yuen.

Presented at *Quantum Information Processing (QIP) 2019*.

In proceedings of *Symposium on Theory of Computing (STOC) 2019*.

2018 Approximate low-weight check codes and circuit lower bounds for noisy ground states.
Chinmay Nirkhe, Umesh Vazirani, Henry Yuen.

In proceedings of *Int'l Coll. on Automata, Languages, and Programming (ICALP) 2018*, pp. 91:1–11.

Presented at *TQC 2018*.

Noise-tolerant testing of high entanglement of formation

Rotem Arnon-Friedman, Henry Yuen.

In proceedings of *Int'l Coll. on Automata, Languages, and Programming (ICALP) 2018*, pp. 11:1–12.

2017 New security notions and feasibility results for authentication of quantum data

Sumegha Garg, Henry Yuen, and Mark Zhandry.

In proceedings of *Annual International Cryptology Conference (CRYPTO) 2017*, pp. 342–371. Presented at *QCrypt 2016*.

Anchoring games for parallel repetition

Mohammad Bavarian, Thomas Vidick, and Henry Yuen.

In proceedings of *Symposium on Theory of Computing (STOC) 2017*, pp. 303–316.

Presented as a Plenary Talk at *Quantum Information Processing (QIP) 2016*.

Multiplayer parallel repetition for expander games

Irit Dinur, Prahladh Harsha, Rakesh Venkat, and Henry Yuen.

In proceedings of *Innovations in Theoretical Computer Science (ITCS) 2017*, pp. 37:1–37:16.

Presented as Invited Talk at ITCS 2017.

Parallel repetition via fortification: analytic view and the quantum case

Mohammad Bavarian, Thomas Vidick, and Henry Yuen.

In proceedings of *Innovations in Theoretical Computer Science (ITCS) 2017*, pp. 22:1–22:33.

Presented at *TQC 2016*.

2016 A parallel repetition theorem for all entangled games

Henry Yuen.

In proceedings of *Int'l Coll. on Automata, Languages, and Programming (ICALP) 2016*, pp. 77:1–77:13.

Presented at *Quantum Information Processing (QIP) 2017*.

A No-Go Theorem for Derandomized Parallel Repetition: Beyond Feige-Kilian

Dana Moshkovitz, Govind Ramnarayan, and Henry Yuen
In proceedings of *APPROX-RANDOM 2016*, pp. 43:3–42:29.

On the sum-of-squares degree of symmetric quadratic functions
Troy Lee, Anupam Prakash, Ronald de Wolf, and Henry Yuen.
In proceedings of *Computational Complexity Conference (CCC) 2016*, pp. 17:1–17:31.

2015 Parallel repetition for entangled k -player games via fast quantum search
Kai-min Chung, Xiaodi Wu and Henry Yuen.
In proceedings of *Computational Complexity Conference (CCC) 2015*, pp. 512–536

2014 Infinite Randomness Expansion and Amplification with a Constant Number of Devices
Matthew Coudron and Henry Yuen.
In proceedings of *Symposium on Theory of Computing (STOC) 2014*, pp. 427–436.
Presented at *Quantum Information Processing (QIP) 2014*

2013 Robust Randomness Amplifiers: Upper and Lower Bounds
Matthew Coudron, Thomas Vidick, and Henry Yuen.
In proceedings of *APPROX-RANDOM 2013*, pp. 468–483.

2012 Continuous Time Channels with Interference
Ioana Ivan, Michael Mitzenmacher, Justin Thaler, and Henry Yuen.
In proceedings of *International Symposium on Information Theory (ISIT) 2012*, pp. 860–864

Journal articles

2020 Exploring entanglement and optimization within the Hamiltonian Variational Ansatz.
Roeland Wiersema, Cunlu Zhou, Yvette de Sereville, Juan Felipe Carrasquilla, Yong Baek Kim, Henry Yuen.
In *Physical Review X Quantum Vol. 1, Iss. 2*.
Available at <https://arxiv.org/abs/2008.02941>

2016 Rescuing Complementarity With Little Drama.
Ning Bao, Adam Bouland, Aidan Chatwin-Davies, Jason Pollack, and Henry Yuen.
In *Journal of High Energy Physics (JHEP)*, 2016:26.

2014 A quantum lower bound for distinguishing random functions from random permutations.
Henry Yuen.
In *Quantum Information and Computation*, 14(9-10), 2014.

2010 DNA Sequencing via Data Mining and Quantum Mechanics.
Henry Yuen, Fuyuki Shimojo, Kevin Zhang, Aiichiro Nakano, Kenichi Nomura, Priya Vashishta.

In *International Journal of Computational Science*, Vol. 4, No. 4, 2010.

Manuscripts

2016 Raz-McKenzie simulation with the inner product gadget.
Xiaodi Wu, Penghui Yao, Henry Yuen.
Electronic Colloquium on Computational Complexity Technical Report 17-010.

A simple proof of Renner's exponential de Finetti theorem.
Thomas Vidick, Henry Yuen.
Available at <https://arxiv.org/abs/1608.04814>

Talks

2021 *Quantum Garbled Circuits.*
UC Berkeley Crypto Seminar.

A Tale of Turing Machines, Quantum-Entangled Particles, and Operator Algebras.
Canada Quantum Days Keynote.

2020 *A Tale of Turing Machines, Quantum-Entangled Particles, and Operator Algebras.*
Richard M. Karp Distinguished Lecture.
University of Toronto Computer Science Distinguished Lecture Series.
Machine Learning in Science and Engineering (organized by Columbia Data Science Institute).
Quantum entanglement through the computational lens
University of Washington.
Columbia University.

$MIP^* = RE$
Canadian Operator Symposium.
Perimeter Institute Seminar.
University of Ottawa CRM Distinguished Speaker Colloquium.
UT Austin Groups & Dynamics seminar.
TCS+ (online).
Institute for Advanced Study (Princeton, New Jersey).
Fields Institute Set Theory Seminar (Toronto, Canada).

Multiprover protocols
Quantum Wave Bootcamp workshop (Berkeley, California).

Perfect zero knowledge for quantum multiprover interactive proofs
Quantum Information Processing 2020 conference (Shenzhen, China).

- 2019 *Connes' Embedding Problem through the lens of complexity theory*
 QLA meets QIT workshop at Purdue University (West Lafayette, Indiana).
 University of Waterloo Pure Math Colloquium (Waterloo, Ontario).
- Perfect zero knowledge for quantum multiprover interactive proofs*
 MIT Cryptography and Information Seminar (Cambridge, Massachusetts).
- Quantum proof systems for iterated exponential time, and beyond*
 BIRS Workshop on the Many Faceted Connes Embedding Problem (Banff, Alberta).
 Symposium on Theory of Computing (STOC) 2019 conference (Phoenix, Arizona).
 Quantum Information Processing (QIP) 2019 conference (Boulder, Colorado).
- Circuit Hamiltonians, Hamiltonian complexity, and approximate error correction.*
 Perimeter Institute Quantum Information Seminar (Waterloo, Ontario).
- 2018 *Quantum proof systems for iterated exponential time, and beyond*
 Theoretical Computer Science seminar, University of Texas, Austin.
 Institute for Quantum Computing Colloquium, University of Waterloo.
 QuICS seminar, University of Maryland.
- Quantum Computing: Our Journey So Far*
 Trinity College, University of Toronto.
- Noise-tolerant testing of high entanglement of formation*
 International Colloquium on Automata, Languages, and Programming (ICALP) 2018
 (Prague, Czech Republic).
- Approximate low-weight check codes and circuit lower bounds for noisy ground states.*
 International Colloquium on Automata, Languages, and Programming (ICALP) 2018
 conference (Prague, Czech Republic).
 Workshop on Quantum Algorithms and Complexity Theory, Center for Quantum Tech-
 nologies, Singapore.
- 2017 *Noise-tolerant testing of high-dimensional entanglement.*
 Invited speaker to Asian Quantum Information Science (AQIS) 2017 conference (Sin-
 gapore)
 Centre for Quantum Information and Control (CQIQC) seminar (Toronto, Canada)
- Parallel repetition for entangled games.*
 Innovations in Theoretical Computer Science (ITCS) 2017 conference (Berkeley, CA)
 Symposium on Theory of Computing (STOC) 2017 conference (Montreal, Canada)
- 2016 *Quantum parallel repetition with polynomial decay.*

Joint Center for Quantum Information and Computer Science (College Park, Maryland)

ICALP conference (Rome, Italy)

Quantum Information Processing (QIP) 2017 conference (Seattle, WA)

Anchoring games for parallel repetition.

Caltech IQIM seminar (Pasadena, CA)

Quantum Information Processing (QIP) 2016 conference (Banff, Canada)

Hebrew University Quantum seminar (Jerusalem, Israel)

Weizmann Institute of Science (Rehovot, Israel)

NYU Theory Seminar (New York, NY)

2015

Parallel repetition for entangled free games.

MIT Algorithms and Complexity Seminar (Cambridge, MA)

Simons Institute Workshop on Information Theory in Complexity and Combinatorics (Berkeley, CA)

CWI Seminar (Amsterdam, Netherlands)

Computational Complexity Conference 2015 (Portland, OR)

Caltech IQIM Group Meeting (Pasadena, CA).

Infinite randomness expansion.

Princeton CS Theory Group Meeting (Princeton, NJ)

Foundations of Randomness Workshop (Stellenbosch Institute of Advanced Study, Stellenbosch, South Africa)

2014

Infinite randomness expansion.

Simons Institute Quantum Gathering seminar, Simons Institute Quantum Games Workshop (Berkeley, CA)

Symposium on the Theory of Computing (STOC) 2014 conference (New York, NY)

CWI Seminar (Amsterdam, Netherlands)

MIT Quantum Computing Group Meeting (Cambridge, MA).

Advising

Postdoc

Cunlu Zhou

PhD

Hamoon Mousavi (CS)

Arthur Mehta (Math)

Gregory Rosenthal (CS, *co-advised with Ben Rossman*).

Adrian She (Math, *co-advised with Toni Pitassi*).

Undergrad

Smik Patel (Summer 2020)

Hugh Goatcher (Summer 2020)

David Cui (2019)

Sajjad Nezhadi (2019)

Yvette De Sereville (Fall 2019)

Teaching

- Fall 2020 CSC2429/MAT1752 Advanced Topics in Quantum Information Theory (Graduate)
- Fall 2019 MAT344 Introduction to Combinatorics (Undergraduate)
CSC2451/MAT1751 Quantum Computing: Foundations to Frontier (Graduate)
- Winter 2019 MAT344 Introduction to Combinatorics (Undergraduate)
- Fall 2018 CSC2451/MAT1751 Quantum Computing: Foundations to Frontier (Graduate)
- Spring 2015 Graduate Instructor in Advanced Complexity Theory, MIT.

Service

Workshop/conference organization

Chair organizer of the *Quantum Protocols: Testing & PCPs* workshop at the Simons Institute *The Quantum Wave in Computing* program in 2020.

Main lecturer of the 5-day *Eighteenth Bellair's Crypto Workshop 2019* on “Applications of non-local games to quantum complexity and quantum cryptography”.

Program committees

Computational Complexity Conference (CCC) 2021
Quantum Information Processing (QIP) 2021
Quantum Information Processing (QIP) 2020
Symposium on Theory of Computing (STOC) 2020
Theory of Quantum Computing (TQC) 2018
Computational Complexity Conference (CCC) 2018
Innovations in Theoretical Computer Science (ITCS) 2017

Conference reviewing

STACS, QIP, STOC, FOCS, SICOMP, TQC, SODA, Theory of Computing Journal, and the Foundations and Trends in Theoretical Computer Science.

References

Provided upon request

Last updated: January 7, 2021