Chinmay Nirkhe

Personal Data

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Current Employment

IBM Quantum
Research Scientist

Thomas J Watson Research Center
1101 Kitchawan Road Yorktown Heights, N.Y. 10598
Dec 2022 -

Education

University of California, Berkeley (GPA: 3.9/4.0)
Aug 2017 - Dec 2022

Ph.D. Candidate in Computer Science
Advisor: Professor Umesh Vazirani
Thesis title: *The description complexity of quantum states*

California Institute of Technology (GPA: 3.9/4.0)
Sep 2013 - Jun 2017

B.S. Mathematics
B.S. Computer Science

Publications

All publications have alphabetical authorship by surname and signify equal contribution by all authors.

[6] **The parametrized complexity of quantum verification**

Srinivasan Arunachalam, Sergey Bravyi, Chinmay Nirkhe, and Bryan O'Gorman. 2021.

In submission. Publically available pre-print: arXiv:2202.08119.

[5] **Quantum search-to-decision and the state synthesis problem**

Sandy Irani, Anand Natarajan, Chinmay Nirkhe, Sujit Rao, and Henry Yuen. 2021.

Presented at 25th Annual Conference on Quantum Information Processing (QIP 2022). In submission. Publically available pre-print: arXiv:2111.02999.

[4] **Circuit lower bounds for low-energy states of quantum code Hamiltonians**

Anurag Anshu and Chinmay Nirkhe. 2021.

In the proceedings of 13th Innovations in Theoretical Computer Science Conference (ITCS 2022). Presented at 24th Annual Conference on Quantum Information Processing (QIP 2021). Publically available pre-print: arXiv:2011.02044.

[3] **Good approximate quantum LDPC codes from spacetime circuit Hamiltonians**

Thomas Bohdanowicz, Elizabeth Crosson, Chinmay Nirkhe, and Henry Yuen. 2019.

In the proceedings of 51st ACM Symposium on the Theory of Computation (STOC 2019). Presented at 5th International Conference on Quantum Error Correction (QEC 2019). (Invited Talk) Presented at 22nd Annual Conference on Quantum Information Processing (QIP 2019).

Publically available pre-print: `arXiv:1811.00277`.

[2] **On the complexity and verification of quantum random circuit sampling**

Adam Bouland, Bill Fefferman, Chinmay Nirkhe, and Umesh Vazirani. 2018.

Published in Nature Physics 2018. Presented at 2020 ACM Conference on Innovations in Theoretical Computer Science (ITCS 2019). Presented at 22nd Annual Conference on Quantum Information Processing (QIP 2019). Publically available pre-print: `arXiv:1803.04402`.

News article published by UC Berkeley News.

[1] **Approximate low-weight check codes and circuit lower bounds for noisy ground states**

Chinmay Nirkhe, Umesh Vazirani, and Henry Yuen. 2018.

In the proceedings of 45th International Colloquium on Automata, Languages, and Programming (ICALP 2018). Presented at 13th Conference on the Theory of Quantum Computation, Communication, and Cryptography (TQC 2018). Publically available pre-print: `arXiv:1802.07419`.

Talks & Presentations

The parametrized complexity of quantum verification
IBM Quantum Research Group, September 2021.

Quantum search-to-decision and the state synthesis problem
Quantum Information Processing, March 2022.
University of Texas, Austin Scott Aaronson's Group Quantum Seminar, December 2021.

Circuit lower bounds for low-energy states of quantum code Hamiltonians
Innovations in Theoretical Computer Science, February 2022.
Simons Institute, Quantum Wave in Computing Reunion Workshop, July 2021.
Stanford Patrick Hayden's Group Quantum Seminar, July 2021.
Caltech Thomas Vidick's Group Quantum Seminar, March 2021.
Quantum Information Processing (QIP), February, 2021.
University of Texas, Austin and MIT Joint Quantum Seminar, December 2020.
Quantum Code Design and Architectures (The European Network) Seminar, November 2020.

Good approximate QLDPC codes from spacetime Hamiltonians
Symposium on the Theory of Computing, June 2019.
Institute for Quantum Computation, University of Waterloo Seminar, April 2019.
UC Berkeley Theory Lunch, February 2019.
Berkeley Quantum Information & Computation Center Seminar, December 2018.

On the complexity and verification of Random Circuit Sampling
Indian Symposium on Quantum Information and Technology, Pune, India, December 2019.
University of Toronto Computer Science / Quantum Information Seminar, March 2019.
IIT Kanpur Computer Science Seminar, December 2018.
Simons Institute Industry Day Lightning Talks, May 2018.
UC Berkeley Visit Days, March 2018.

Approximate low-weight check codes and circuit lower bounds for noisy ground states
Theory of Quantum Computing, July 2018.
Institute for Theoretical Physics Seminar, May 2018.
Caltech IQIM, February 2018.

Other talks
UC Berkeley Quantum Brainstorming Session, December 2021.

Past Employment and Research Positions

IBM Quantum. San Jose, Calif. and Yorktown Heights, NY. PhD Quantum Research Intern. May - December 2021.

Jane Street Capital. New York City, NY. Software Engineer Intern. Summer 2016.

Caltech Research for Course Credit, Professor Thomas Vidick. Summer and Fall 2016. Theoretical computer science research on pseudo-telepathy quantum games and certifiable randomness generation.

Twitter, Inc. San Francisco, CA. Software Engineer Intern. Summer 2015.

Caltech Summer Undergraduate Research Fellowship, Professor Thomas Apostol. Summer 2014. Mathematics research on the geometry of brachistochrone and tautochrones in radially dependent force fields.

University of Washington, Professor Jacob O. Wobbrock. Fall 2012. Human computer interaction research on novel text entry systems using *Microsoft Kinect* for midair freehand gestural input. Unpublished publication: C. Nirkhe, J. Wobbrock; *The Bubble Keyboard: A Midair Freehand Gestural Text Entry Method.*

Awards

UC Berkeley EECS Nominee for the Microsoft Research PhD Fellowship 2019
National Science Foundation Graduate Research Fellowship Honourable Mention 2017
Microsoft Teaching in Computational Mathematical Sciences (CMS) Prize 2017
Associated Students of the California Institute of Technology (ASCIT) Teaching Award 2017
National Merit Semifinalist 2012

Teaching Positions

Quantum Interactive Protocols
Lecturer; University of California, Berkeley Spring 2022.
The Mathematics of Quantum Computation
Teaching Assistant; Hebrew University of Jerusalem: The 4th Winter School in Computer Science and Engineering Fall 2019.
CS 294-6: Quantum Computation
Teaching Assistant; University of California, Berkeley Fall 2019.
Trends in Theory: Quantum Computation
Teaching Assistant; University of California, San Diego Spring 2018.
CS 170: Efficient Algorithms and Intractable Problems
Teaching Assistant; University of California, Berkeley Spring 2018.
CS 38: Introduction to Algorithms
Head Teaching Assistant; California Institute of Technology Spring 2016, Spring 2017.
CS 139: Advanced Algorithms
Teaching Assistant; California Institute of Technology Winter 2017.
CS 156a: Learning Systems
Teaching Assistant; California Institute of Technology Fall 2016.
CS 21: Decidability and Tractability

Teaching Assistant; California Institute of Technology Winter 2016.

MENTORSHIP

Jyoti Rani Spring 2022, UC Berkeley undergraduate.
Samyak Surti Spring 2022, UC Berkeley undergraduate.
James Chen Summer & Fall 2020, UC Berkeley undergraduate, now quantitative trading at Jane Street Capital.
Natalie Parham Summer & Fall 2020, UC Berkeley undergraduate, now a Masters student at U. of Waterloo.
Sahil Patel Summer & Fall 2020, UC Berkeley undergraduate, now a Masters student at UC Berkeley.

SERVICE

(Anonymous) reviewer for

- (Conferences) CCC 2018, RANDOM 2018, TCC 2018, TQC 2018, CCC 2019, QCRYPT 2019, QIP 2019 (2), QIP 2020 (4), STOC 2020 (2), FOCS 2020, SODA 2021, ITCS 2021, STOC 2021 (3), TQC 2021, ITCS 2022 (2), QIP 2022 (3), STOC 2022 (2) and FOCS 2022 (2).
- (Journals) Quantum (2).

REFERENCES

Professor Umesh Vazirani, University of California, Berkeley. vazirani@cs.berkeley.edu.
Assistant Professor Henry Yuen, Columbia University. henry.yuen@columbia.edu.
Assistant Professor Anurag Anshu, Harvard University. anuraganshu@seas.harvard.edu.

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