Anirban Chowdhury

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Google Scholar `https://scholar.google.com/citations?user=J_YlQ2oAAAAJ`
Webpage `https://anchowdhury89.github.io/`

Employment

2020 – now **Postdoctoral Fellow**, Institute for Quantum Computing and Department of Combinatorics & Optimization, University of Waterloo.

2019 – 2020 **Postdoctoral Researcher**, Département de physique, Université de Sherbrooke.

Research Interests

quantum algorithms, complexity and classical approximation algorithms for simulating quantum systems

Education

2013–2019 **PhD in Physics**, University of New Mexico.
Dissertation: Quantum algorithms with applications to physics simulations

2013–2016 **MS in Physics**, University of New Mexico.

2008–2013 **BS-MS**, Indian Institute of Science Education and Research Pune.
Thesis: Quantum measurements with post-selection

Publications

Published articles

1. Sergey Bravyi, Anirban Chowdhury, David Gosset and Pawel Wocjan, *Quantum Hamiltonian complexity in thermal equilibrium,* Nat. Phys. 18, pp. 1367–1370 (2022)
2. Anirban N. Chowdhury, Rolando D. Somma and Yigit Subasi, *Computing partition functions in the one-clean-qubit model,* Phys. Rev. A 103, 032422 (2021)
3. Anirban Narayan Chowdhury and Rolando D. Somma, *Quantum algorithms for Gibbs sampling and hitting-time estimation,* Quant. Inf. Comp. Vol. 17, No. 1/2, pp. 0041-0064 (2017)
4. Anirban N. Chowdhury, Mandar Patil, Daniele Malafarina and Pankaj S. Joshi, *Circular geodesics and accretion disks in Janis-Newman-Winicour and Gamma metric,* Phys. Rev. D 85, 104031 (2012)

Preprints

1. Adam Bene Watts, Anirban Chowdhury, Aidan Epperly, J. William Helton, Igor Klep, *Relaxations and Exact Solutions to Quantum Max Cut via the Algebraic Structure of Swap Operators*,arXiv:2307.15661(2023)
2. Sergey Bravyi, Anirban Chowdhury, David Gosset, Vojtech Havlicek and Guanyu Zhu, *Quantum complexity of the Kronecker coefficients*, arXiv:2302.11454(2023)
3. Chen-Fu Chiang, Anirban Chowdhury and Pawel Wocjan, *Space-efficient Quantization Method for Reversible Markov Chains,* arXiv:2206.06886 (2022)
4. Anirban N. Chowdhury, Guang Hao Low and Nathan Wiebe, *A variational quantum algorithm for preparing quantum Gibbs states,* arXiv:2002.0005 (2020)
5. Anirban Narayan Chowdhury, Yigit Subasi and Rolando D. Somma, *Improved implementation of reflection operators,* arXiv:1803.02466 (2018)

Citations

(Source: Google Scholar as of September 2023)

- Total: 338
- Since 2017: 285

Patents

Guang Hao Low, Nathan Wiebe and Anirban Chowdhury, *Variational quantum Gibbs state preparation,* Document ID: US 20200349457 A1, Date published: 2020-11-05

Invited Talks

Jun 2023 **University of Waterloo**, Waterloo, Canada.
Approximation algorithms for dense quantum Hamiltonians using convex relaxations

May 2023 **Indian Institute of Science Education and Research**, Pune, India.
Quantum Hamiltonian Complexity in thermal equilibrium

Feb 2023 **Virgnia Tech**, Blacsburg, USA.
Quantum simulation and complexity of thermal physics

Dec 2022 **École de technologie supérieure (ÉTS) Montréal**, Montreal, Canada.
Quantum computing for quantum physics and beyond

Mar 2022 **The Institute for Fundamental Study**, Phitsanulok, Thailand (remote).
Complexity of approximating quantum many-body physics in thermal equilibrium

Mar 2022 **Technology Innovation Institute**, Abu Dhabi, UAE (remote).
Approximating quantum many-body physics in thermal equilibrium

Feb 2022 **Los Alamos National Laboratory**, Los Alamos, USA (remote).
Approximating the free energy of dense quantum Hamiltonians using convex relaxations

Feb 2022 **University of New Mexico**, Albuquerque, USA (remote).
Approximating the free energy of dense quantum Hamiltonians using convex relaxations

Jan 2022 **IPAM Quantum Numerical Linear Algebra Workshop**, Los Angeles, USA (remote).
Classical and quantum algorithms for estimating traces and partition functions
Recording: `https://www.youtube.com/watch?v=xiwpH9i3m5g`

Apr 2021 **University of Bristol**, Bristol, UK (remote).
Computing partition functions with one clean qubit

Mar 2020 **University of Waterloo**, Waterloo, Canada.
Simulating thermal physics on quantum computers

Aug 2019 **Los Alamos National Laboratory**, Los Alamos, USA.
Improved quantum simulation algorithms using a linear combination of unitaries

Conference Talks

Jul 2022 **Theory of Quantum Computation, Communication and Cryptography**, Urbana, USA.
On the complexity of quantum partition functions
Recording: `https://youtu.be/j1jlPPKBvNc?t=4260`

Mar 2022 **Quantum Information Processing**, Pasadena, USA.
On the complexity of quantum partition functions

Jun 2020 **Theory of Quantum Computation, Communication and Cryptography Conference**, Latvia (remote).
Computing partition functions with one clean qubit

Nov 2019 **INTRIQ meeting**, Bromont, Canada.
Simulating thermal physics on quantum computers

Feb 2019 **American Physical Society March Meeting**, Boston, USA.
Improved implementation of reflection operators

Feb 2018 **Southwest Quantum Information and Technology Workshop**, Santa Fe, USA.
Improved quantum algorithms using linear combination of unitaries

Mar 2016 **American Physical Society March Meeting**, Baltimore, USA.
Quantum algorithms for hitting-time estimation

Professional Activities

- Reviewer for Physical Review A, New Journal of Physics, ACM Transactions in quantum information processing, Quantum Information Processing journal, npj Quantum Information, Quantum journal, PRX Quantum and Physical Review X
- Subreviewer for QIP 2022 and 2023, FOCS 2021, TQC 2020 and 2022
- Co-organizer of Perimeter Institute Quantum Discussions seminar series, 2022
- Session chair for TQC 2020

Mentorship

Co-supervised a Master's research essay as part of the Perimeter Scholars International program.

Programming and Software

- Python, Mathematica and MATLAB for numerical simulations
- LaTeX for technical writing
- Familiarity with HTML, CSS

Past Employment

2018 – 2019 **Graduate Student**, Los Alamos National Laboratory.

2018 **Research Intern**, Microsoft Corporation.

2016 – 2017 **Student Researcher**, New Mexico Consortium.

2013 – 2015, 2017 **Teaching Assistant**, University of New Mexico.

Academic Honours & Awards

2018-2019 Graduate Research Assistantship, Los Alamos National Laboratory

2017 National Science Foundation (NSF) travel award

2015 UNM Graduate and Professional Students Association (GPSA) Professional Development Grant

2012 Selected for the Visiting Students Program in physics at Harishchandra Research Institute, Allahabad, India

2011 Visiting Students Research Program (VSRP), Tata Institute of Fundamental Research, Mumbai, India

2008–2013 Recipient of the Innovation in Science Pursuit for Inspired Research (INSPIRE) Scholarship for Higher Education, administered by the Department of Science & Technology, Government of India

Other Research Experience

2012 **Study of quantum games**, *Indian Institute of Science Education & Research Pune*, Advisor: T. S. Mahesh.

2011 **Field theory in light-cone gauge**, *Indian Institute of Science Education & Research Pune*, Advisor: Sudarshan Ananth.

2011 **Synchronization in nanomechanical oscillators**, *Indian Institute of Science Education & Research Pune*, Advisor: G. Ambika.

2010 **Theories of extra dimensions**, *Indian Association for the Cultivation of Science*, Advisor: Soumitra Sengupta.

References

1. Rolando D. Somma
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   ✉ rsomma@google.com
2. David Gosset
   University of Waterloo
   ✉ david.gosset@uwaterloo.ca
3. Nathan Wiebe
   University of Toronto
   ✉ nawiebe@cs.toronto.edu
4. Pawel Wocjan
   IBM T. J. Watson Research Center
   ✉ pawel.wocjan@ibm.com