

# Anirban Chowdhury

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## Current Position

Postdoctoral Fellow, Institute for Quantum Computing, University of Waterloo

## Research Interests

quantum algorithms, quantum simulation, classical algorithms for quantum simulation, quantum information

## Past Employment

- 2019–2020 **Postdoctoral Researcher**, *Université de Sherbrooke*.  
— research in quantum algorithms for simulating many-body physics
- 2018–2019 **Graduate Research Assistant**, *Los Alamos National Laboratory*.  
— worked on quantum algorithms for simulation and optimization problems
- 2018 **Research Intern**, *Microsoft Corporation*.  
— developed hybrid quantum-classical algorithms for state preparation with view towards near-term applications.
- 2016–2017 **Student Researcher**, *New Mexico Consortium*.  
— investigated quantum algorithms for characterizing and speeding up random walks and Markov processes, with relevance to improving simulation of physical processes.
- 2013–2015 & 2017–2017 **Teaching Assistant**, *University of New Mexico*.  
— instructor for introductory physics lab courses; graded homework and assisted students with homework problems for graduate quantum mechanics.

## Education

- 2013–2019 **PhD in Physics**, *University of New Mexico*.  
Advisor: Rolando D. Somma  
Dissertation: Quantum algorithms with applications to physics simulations
- 2013–2016 **MS in Physics**, *University of New Mexico*, CGPA: 3.67/4.00.
- 2008–2013 **BS-MS**, *Indian Institute of Science Education and Research Pune*, CGPA: 8.8/10.0.  
MS Thesis: Quantum measurements with post-selection

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## Publications

### Published articles

1. Anirban N. Chowdhury, Rolando D. Somma and Yigit Subasi, *Computing partition functions in the one-clean-qubit model*, Phys. Rev. A 103, 032422 (2021)
2. 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)
3. 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. Anirban N. Chowdhury, Guang Hao Low and Nathan Wiebe, *A variational quantum algorithm for preparing quantum Gibbs states*, arXiv:2002.0005 (2020)
2. Anirban Narayan Chowdhury, Yigit Subasi and Rolando D. Somma, *Improved implementation of reflection operators*, arXiv:1803.02466 (2018)

### Citations

(Source: Google Scholar as of Aug 23, 2021)

○ Total: 175

○ Since 2016: 148

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## Conference Presentations

- Jun 2020 **Theory of Quantum Computation, Communication and Cryptography Conference**, Latvia (remote).  
— oral presentation on *computing partition functions with one clean qubit*
- Nov 2019 **INTRIQ meeting**, Bromont, Canada.  
— oral presentation on *simulating thermal physics on quantum computers*
- Feb 2019 **American Physical Society March Meeting**, Boston, USA.  
— oral presentation on *improved implementation of reflection operators*
- Feb 2018 **Southwest Quantum Information and Technology Workshop**, Santa Fe, USA.  
— oral presentation on *improved quantum algorithms using linear combination of unitaries*
- Feb 2017 **Southwest Quantum Information and Technology Workshop**, Baton Rouge, USA.  
— poster presentation on *quantum algorithms for Gibbs-sampling and hitting-time estimation*
- Jan 2017 **Quantum Information Processing 2017**, Seattle, USA.  
— poster presentation on *quantum algorithms for Gibbs-sampling and hitting-time estimation*
- Mar 2016 **American Physical Society March Meeting**, Baltimore, USA.  
— oral presentation on *quantum algorithms for hitting-time estimation*

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## Invited Talks

- 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*
- Jul 2019 **Los Alamos National Laboratory – Quantum Lunch seminar**, Los Alamos, USA.  
*Quantum algorithms with applications to simulating physical systems*

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## 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

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## Professional Activities

- Reviewer for Physical Review A, New Journal of Physics, Quantum Information Processing journal, npj Quantum Information, Quantum journal, PRX Quantum and Physical Review X
- Subreviewer for FOCS 2021, TQC 2020
- Session chair for TQC 2020

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## Programming and Software

- Python, MATLAB and Mathematica for numerical simulations
- $\text{\LaTeX}$  for technical writing
- Familiarity with HTML, CSS from volunteer work in website development and maintenance

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## Past Research Experience

- 2012 **Study of quantum games**, *Indian Institute of Science Education & Research Pune*, Advisor: T. S. Mahesh.  
Studied quantum games and their utility in devising quantum search algorithms.
- 2011 **Field theory in light-cone gauge**, *Indian Institute of Science Education & Research Pune*, Advisor: Sudarshan Ananth.  
Studied the properties of field theoretic Lagrangians and actions in the light-cone gauge which removes non-essential degrees of freedom from the theory.
- 2011 **Synchronization in nanomechanical oscillators**, *Indian Institute of Science Education & Research Pune*, Advisor: G. Ambika.  
Numerically modelled and characterized the dynamics of two coupled nonlinear oscillators with the use of phase-portraits, bifurcation maps, basin structure.
- 2010 **Theories of extra dimensions**, *Indian Association for the Cultivation of Science*, Advisor: Soumitra Sengupta.  
Studied the Kaluza-Klein model of higher dimensional gravity, and the Randall-Sundrum model of large extra dimensions which proposes to solve mass hierarchy problems in theoretical physics.

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## References

1. Rolando D. Somma  
Staff Scientist, Theoretical Division  
Los Alamos National Laboratory  
✉ [somma@lanl.gov](mailto:somma@lanl.gov)
2. Nathan Wiebe  
Assistant Professor, Department of Computer Science  
University of Toronto  
✉ [nwiebe@cs.toronto.edu](mailto:nwiebe@cs.toronto.edu)
3. Ivan Deutsch  
Director, Center for Quantum Information & Control  
Department of Physics and Astronomy  
University of New Mexico  
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