Soumik Ghosh

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Education

2020 -	**University of Chicago** Percentage : 100/100 Program : Ph.D. in Computer Science Supervisor : Prof. William Fefferman
2018 - 2020	**University of Waterloo** Program : M.Math in Computer Science (Quantum Information) Percentage : 95.2/100 Thesis : 'A study of one-turn quantum refereed games' Supervisor : Prof. John Watrous Readers : Prof. John Watrous, Prof. Richard Cleve, Prof. David Gosset
2014 - 2018	**Jadavpur University** Program : Bachelor of Engineering (B.E.) in Electronics Engineering CGPA : 9.5/10 (Passed First Class with Honours)

Research Interests

I have broad interests in **quantum computing**. Specific topics that I am interested in include **quantum complexity theory, quantum algorithms, quantum information theory, quantum proof systems, quantum cryptography**, and **the theory of entanglement**. I am also interested in **algorithms, complexity theory**, and **theoretical computer science** more generally.

Manuscripts

1. Fefferman, Bill, **Ghosh, Soumik**, Gullans, Michael, Kuroiwa, Kohdai, and Sharma, Kunal. **Effect of non–unital noise on random circuit sampling.** [PDF]

2. Aaronson, Scott, Bouland, Adam, Fefferman, Bill, **Ghosh, Soumik**, Vazirani, Umesh, Zhang, Chenyi, and Zhou, Zixin. **Quantum Pseudoentanglement.** [PDF] (Accepted for a talk at **QIP 2023**.)

3. **Ghosh, Soumik**, Deshpande, Abhinav, Hangleiter, Dominik, Gorshkov, Alexey, and Fefferman, Bill. **Sharp complexity phase transitions generated by entanglement.** [PDF] (Accepted to **Physical Review Letters**.)

4. **Ghosh, Soumik**, and Watrous, John. **Complexity limitations on one-turn quantum refereed games.** [PDF] (Accepted for a poster presentation at **QIP 2021**.) In: **Theory of Computing Systems (Springer)**, December 2022.

Research Projects

Ph.D. research

2021 - **Pseudorandomn properties random quantum quantum circuits.**
With: Professor William Fefferman, Professor Adam Bouland (Stanford University), Professor David Gosset (University of Waterloo)
Description: Utilizing tools from complexity theory to shed more light into the study of random quantum circuits, especially constructing pseudorandom states using such cicruits.

2021 - **Boundaries of classical simulations of quantum computation.**
With: Professor William Fefferman, Professor Alexey Gorshkov (University of Maryland, College Park), Dr. Abhinav Deshpande (Caltech)
Description: Characterizing the boundary between quantum and classical computing and the nature of quantum speedups.

2021 - **Noise in near-term quantum circuits.**
With: Professor William Fefferman, Kohdai Kuroiwa (University of Waterloo), Dr. Kunal Sharma (IBM)
Description: Working on characterizing different types of noises in near-term quantum devices which are used in optimization.

2021 - **Designing quantum advantage experiments in a cold atom architecture.**
With: Professor William Fefferman, Professor Hannes Bernien (University of Chicago), Professor Hannes Pichler (University of Innsbruck)
Description: Formulating the theory for quantum advantage experiments in a cold atom architecture designed by the Bernien group.

2022 - **Designing quantum advantage experiments in a distributed quantum network.**
With: Professor William Fefferman, Professor Frederic Chong (University of Chicago)
Description: Formulating the theory for quantum advantage experiments for distributed quantum computing experiments.

Master's research

2018 - 2020 **Characterizing one turn quantum refereed games.**
Supervisor: Professor John Watrous, Institute for Quantum Computing
Description: Utilizing tools from complexity theory to analyze the complexity limitations on quantum proof systems with two competing quantum provers.

2018 - **Characterizing shallow depth quantum circuits.**
Collaborator: Dr. Matthew Coudron, University of Maryland, College Park
Mentor: Dr. David Gosset, Institute for Quantum Computing
Description: Looking into quantum advantage with constant and logarithmic depth quantum circuits.

Achievements

2020 Awarded the Daniels Fellowship for being one of the strongest Ph.D. students of the incoming cohort at the University of Chicago (valued at 15,000 USD for one year, in addition to the normal graduate stipend).

2019 One of only five international students in the entire University of Waterloo to be awarded the prestigious **Ontario Graduate Scholarship** for academic and research excellence (valued at 15,000 CAD per year).

2019 Only international Master's student in the entire Mathematics faculty in the University of Waterloo to be awarded the prestigious **President's Graduate Scholarship** for academic and research excellence (valued at 10,000 CAD per year).

2017 Awarded the prestigious **Viterbi-India fellowship** for research at USC Viterbi for the summer of 2017 (one of 19 out of more than 350 applicants) with Professor Itay Hen.

2017 Awarded the prestigious **DAAD-WISE fellowship** for research in Germany in 2017 at Technische Universität Dortmund with Professor Dieter Suter.

Teaching Assistantships

Fall 2018 Course: **MATH 643**
Instructor: Professor Naomi Nishimura, University of Waterloo
Description : Online course on the **theory of computation**, designed for students pursuing an online Master's degree from the University of Waterloo.

Fall 2019 Course: **MATH 641**
Instructor: Professor Naomi Nishimura, University of Waterloo
Description : Online course on the **algorithm design and analysis**, designed for students pursuing an online Master's degree from the University of Waterloo.

Technical Skills

Languages C, C++, Mathematica

Research tools Matlab, Mathematica, Maple

Test Scores

September 2017 **Graduate Record Examination (GRE)**
Score: 339/ 340, Quant - 170/170, Verbal - 169/170, AWA - 5/6

Service

Professional Service

June 2019	Chaired the quantum computing session at the **Canadian Graduate Quantum Conference, 2019.**
2019 - 2020	Part of the team organizing the Canadian Graduate Quantum Conference, 2020.

Extracurricular Service

July 2019 -	Member of **'bigyan.org'** - an online portal to popularize science in the Bengali language.
2019 -	Member and team leader of the Institute for Quantum Computing (IQC), Graduate Student Association.
October 2019 -	Collaborating with **Aquanty**, an environmental startup, to develop deep learning techniques for hydrological forecasting.

References

Available upon request.