# Arkaprava Choudhury

*Updated May 2, 2024*

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## Interests

Quantum computing; Theoretical computer science; Pure mathematics

## Education

**University of Toronto, St. George** — Toronto, ON, Canada
HBSc (H.D.): Computer Science and Mathematics specialist programs, Physics minor — *Aug 2020 - Aug 2024*
Dean's List scholar (3.88 CGPA), Chancellor's scholarship, International entrance award,
CQIQC summer undergraduate fellowship, DCS summer research award, Samuel Beatty scholarship, TAship
*Relevant courses:* Advanced algorithm design, Quantum algorithms, Complexity theory, Error correction, Derandomisation, Systems programming, Operating systems, Software design, Computer organization, K-theory and C*-algebras, Differential geometry, Complex analysis, Abstract algebra, Topology
*Clubs:* UofT quantum computing club, UofT CS undergraduate theory society, Computer Science student union

**Goldcrest International School** — Navi Mumbai, MH, India
International Baccalaureate Diploma Programme — *July 2018 - July 2020*
Valedictorian - Batch of 2020; Head of School's Award; MISA Outstanding Learners Award

## Experience

**CSC310 Information Theory Teaching Assistantship** — Toronto, ON, Canada
TA in Department of CS for Information Theory, taught by Prof. Swastik Kopparty; — *Winter 2024*
Graded assignments and exams, held tutorials and TA office hours for a class of 109 students.

**CSC494 Computer Science Research Project** — Toronto, ON, Canada
Undergraduate research student under Prof. Nathan Wiebe — *Fall 2023*
Worked on a more practical alternate version of a quantum simulation algorithm for simulating coupled classical oscillators using less information about the system, and lower bounds on a change of representation.

**CQIQC Summer Undergraduate Fellowship** — Toronto, ON, Canada
Summer undergraduate research student under Prof. Nathan Wiebe — *Summer 2022*
Worked on creating a generalized framework for quantum simulation algorithms using the Feynmann clock construction to allow for simulating operators with non-trivial interaction across different time-steps.

**DCS Summer Research Program** — Toronto, ON, Canada
Summer undergraduate research student in the Department of Computer Science at UofT — *Summer 2022*
Worked with Prof. Allan Borodin on studying online algorithms and mechanism design, and identifying open problems and gaps between best known results for competitive ratios for prophet inequalities and for online bin packing.

**MatterLab group** — Toronto, ON, Canada
Part-time undergraduate research student at MatterLab — *Winter – Fall 2022*
Work on automatized implementation of a quantum variational autoencoder to detect phase transitions. Also continued to work on previous tasks from the Research Opportunity Program.

**Research Opportunity Program** — Toronto, ON, Canada
Summer undergraduate research student at MatterLab — *Summer 2021*
Contributed to Tequila open-source package working on implementing quantum algorithms and optimising quantum circuits, in Prof. Alán Aspuru-Guzik's group at UofT.

## Other projects

**MentPy programming library for automatized measurement-based QML** — *Oct 2023 – present*
Open-source Python programming library for measurement-based quantum computing and applications in QML.

**Extensions to simulating coupled spring systems** — *Summer 2023*
Independent projects under Prof. Nathan Wiebe, looking at a pseudo-dequantisation and a qubit-efficient nonunitary simulation for the result about quantum simulation of coupled classical oscillator systems; working on pre-print.

**Mathematics Specialist First-Year Learning Community Peer Mentor** *Fall 2023 – Winter 2024*
Peer mentor for Mathematics Specialist first-year learning community, Faculty of Arts and Science and the Department of Mathematics, hosting weekly sessions to facilitate undergraduates through their first-year at UofT's Math program.

**Program development director at Q-SITE conference** *May - Oct 2022, May – Oct 2023*
Planning committee for program scheduling, correspondence with speakers, and student poster session.

**UofT Quantum Computing (UTQC) club** *Dec 2021 - present*
Writer for weekly newspiece and literature review for quantum computing seminar series. Hosting weekly intro to quantum computation sessions for early undergrads.

**Regex visualization toolkit and language parser system** *Sep - Dec 2021*
Creating Android app (Java) for implementing efficient systems for visualization of input regex string and checking for pattern-matches among all consecutive substrings of an input test string

**Automatized implementation of nonunitary embeddings in quantum computers** *May – Nov 2021*
Implementing generalized techniques to embed non-unitary operations in an automatized way. Extended project to implement further applications of the algorithm such as simulation and measurement reduction.

**Animmend: Interactive anime recommendations** *Mar - Apr 2021*
Implementation of efficient search and recommendation algorithms using sparse dynamic graphs.

## Talks given

**DCS Summer Research Presentations** *Aug 2022*
Presented a talk on some open problems in online algorithm design.

**Canadian Undergraduate Math Conference** *June 2023*
Presented a talk on the error-correcting codes using expander graphs.

**Canadian Undergraduate Math Conference** *July 2022*
Presented a talk on the problem of fair online resource allocation.

## Other courses

**TRIUMF Summer Institute Virtual Summer School** *Aug 2021*
**UC Berkeley's CS191X: Quantum Mechanics and Quantum Computation** *June - Aug 2020*
**Qubit-by-Qubit's Introduction to Quantum Computing** *Oct 2020 - May 2021*
**Harvard's CS50 series** *May - June 2020*
**Vanderbilt University's Introduction to Programming with MATLAB** *May 2020*

## Skills

**Programming languages**: Python, Java, Assembly, MATLAB, LaTeX
**Frameworks and libraries**: Tequila, Pennylane, Qiskit, TensorFlow, MentPy

## Volunteering

**UofT CS Undergraduate Theory Society** *Oct 2023 – present*
**Q-SITE Undergraduate Conference** (Program development director) *May 2022 – Oct 2023*
**UofT Quantum Computing Club** *Dec 2021 – present*
**UofT AWM High-School Mentorship** *Nov 2021 – Apr 2022*
**ZNotes: Notes for AS/A levels and IBDP** *Mar 2019 – Mar 2020*

## Events

**Q-SITE Conference** *Oct 2022; Sep 2023*
**qLearn: Quantum Algorithms** *Winter 2023; Fall 2023*
9 week introduction to early quantum algorithms series for undergraduates, held through the UofT QC club.
**UofTHacks 2021** *Feb 2021*
**Raising a Mathematician Training Program** *May 2016*
Selected among top 100 students across India for an intensive course on calculus, linear algebra, and vedic math.