

# IAN MERTZ

## Contact

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## Employment

Computer Science Institute (IUUK)  
Faculty of Mathematics and Physics  
Charles University, Czech Republic

## WORK, EDUCATION, & FUNDING

### WORK (PRIMARY)

**Charles University (Prague, Czech Republic)** ..... Fall 2024 -  
*Postdoctoral researcher*  
Advisor: Michal Koucký

**University of Warwick (Coventry, UK)** ..... Fall 2022 - Fall 2024  
*Postdoctoral researcher*  
Advisor: Igor Carboni Oliveira

### EDUCATION (PRIMARY)

**University of Toronto (Toronto, ON, Canada)** ..... Winter 2018 - Summer 2022  
*Ph.D. in Computer Science* ..... Thesis: *The Complexity of Composition:  
New Approaches to Depth and Space*  
Advisor: Toniann Pitassi

**University of Toronto (Toronto, ON, Canada)** ..... Fall 2016 - Winter 2018  
*M.Sc. in Computer Science* ..... Thesis: *Proof Complexity and Automatability*  
Advisor: Toniann Pitassi, Stephen Cook

**Rutgers University - New Brunswick (Piscataway, NJ, USA)** ..... Fall 2012 - Spring 2016  
*B.S. in Computer Science, B.A. in Mathematics,* ..... Thesis: *Complexity Theory Through a  
B.A. in East Asian Language Studies (concentration in Japanese)* ..... Spectrum of Computation Models  
Advisor: Eric Allender  
Summa cum laude, honors program

### EDUCATION (EXTERNAL)

**Simons Institute for the Theory of Computing** ..... Spring 2023  
*Special Semester on Metacomplexity, visiting researcher*

**Institute for Advanced Study** ..... Fall 2017, Spring 2019,  
*Visiting graduate student researcher* ..... Spring 2020, Spring 2022

**Simons Institute for the Theory of Computing** ..... Fall 2018  
*Special Semester on Lower Bounds in Complexity Theory, visiting graduate student researcher*

**Ritsumeikan University** ..... Summer 2015  
*Study abroad semester*

**Princeton University, Rutgers University-Camden** ..... Summer 2011 - Summer 2012  
*Rajiv Gandhi (Rutgers University-Camden)*

# RESEARCH FUNDING

|                                                                                                |             |
|------------------------------------------------------------------------------------------------|-------------|
| Grant Agency of the Czech Republic ( <i>Michal Koucký</i> )                                    | 2024 -      |
| Royal Society URF ( <i>Igor Carboni Oliveira</i> )                                             | 2022 - 2024 |
| Natural Sciences and Engineering Research Council of Canada (NSERC) ( <i>Toniann Pitassi</i> ) | 2016 - 2022 |
| National Science Foundation (NSF) ( <i>Eric Allender</i> )                                     | 2013 - 2016 |

# PERSONAL GRANTS, HONORS, & AWARDS

|                                                              |             |
|--------------------------------------------------------------|-------------|
| Computer Science 50th Anniversary Graduate Scholarship       | 2022        |
| Alfred B. Lehman Graduate Scholarship in Computer Science    | 2021        |
| NSF Graduate Research Fellowship Program - Honorable Mention | 2016        |
| Dean's List                                                  | 2012 - 2016 |
| Scarlet Scholarship                                          | 2012 - 2016 |
| NSF Research Experience for Undergraduates (REU)             | 2014        |
| School of Arts and Sciences Excellence Award                 | 2013        |
| Aresty Summer Science Program                                | 2013        |

# RESEARCH

## RESEARCH INTERESTS

- catalytic computation
  - space complexity
- composition theorems
  - automatability
- circuit complexity
  - combinatorics

## PUBLICATIONS

### Quantum Catalytic Computing

Harry Buhrman, Marten Folkertsma, Ian Mertz, Florian Speelman, Sergii Strelchuk, Sathya Subramanian, Quinten Tupker  
Theory of Quantum Computation, Communication and Cryptography (TQC), 2025.

### Catalytic Computing and Register Programs Beyond Log-Depth

Yaroslav Alekseev, Yuval Filmus, Ian Mertz, Aleksander Smal, Antoine Vinciguerra  
Mathematical Foundations of Computer Science (MFCS), 2025.

### Bipartite Matching is in Catalytic Logspace

Aryan Agarwala, Ian Mertz  
Foundations of Computer Science (FOCS), 2025.

### Collapsing Catalytic Classes

Michal Koucký, Ian Mertz, Ted Pyne, Sasha Sami  
Foundations of Computer Science (FOCS), 2025.

### The Structure of Catalytic Space: Capturing Randomness and Time via Compression

James Cook, Jiayu Li, Ian Mertz, Ted Pyne  
Symposium on Theory of Computing (STOC), 2025.

### Fully Characterizing Lossy Catalytic Computation

Marten Folkertsma, Ian Mertz, Florian Speelman, Quinten Tupker  
Innovations in Theoretical Computer Science (ITCS), 2025.

### Tree Evaluation is in Space $O(\log n \cdot \log \log n)$

James Cook, Ian Mertz  
SIAM Journal of Computing (SICOMP), STOC 2024 special issue.  
Symposium on Theory of Computing (STOC), 2024.

## Reusing Space: Techniques and Open Problems

*Ian Mertz*

Bulletin of the EATCS, 2023.

## Trading Time and Space in Catalytic Branching Programs

*James Cook, Ian Mertz*

Computational Complexity Conference (CCC), 2022.

## Lifting with Sunflowers

*Shachar Lovett, Raghu Meka, Ian Mertz, Toniann Pitassi, Jiapeng Zhang*

Innovations in Theoretical Computer Science (ITCS), 2022.

## Encodings and the Tree Evaluation Problem

*James Cook, Ian Mertz*

Electronic Colloquium on Computational Complexity (ECCC), 2021.

## Automating Cutting Planes is NP-hard

*Mika Göös, Sajin Korothe, Ian Mertz, Toniann Pitassi*

Symposium on Theory of Computing (STOC), 2020.

## Catalytic Approaches to the Tree Evaluation Problem

*James Cook, Ian Mertz*

Symposium on Theory of Computing (STOC), 2020.

## Short Proofs Are Hard to Find

*Ian Mertz, Toniann Pitassi, Yuanhao Wei*

International Colloquium on Automata, Languages and Programming (ICALP), 2019

## Complexity of Regular Functions

*Eric Allender, Ian Mertz*

Journal of Computer and System Sciences (JCSS), **LATA 2015 special issue**, 2019.

Language and Automata Theory and Applications (LATA), 2015.

## Dual VP Classes

*Eric Allender, Anna Gál, Ian Mertz*

computational complexity, 2017.

Mathematical Foundations of Computer Science (MFCS), 2015.

## RESEARCH TALKS

### Invited

CCC 2025 (Toronto, Canada) ..... August 6, 2025

Dagstuhl Complexity Workshop (Wadern, Germany) ..... March 11, 2025

ToniCS (Berkeley, CA, USA) ..... March 27, 2023

### Conference

STOC 2024 (Vancouver, BC, Canada) ..... June 26, 2024

CCC 2022 (Philadelphia, PA, USA) ..... July 23, 2022

ITCS 2022 (Zoom) ..... February 3, 2022

STOC 2020 (Zoom) ..... June 22, 2020

ICALP 2019 (Patras, Greece) ..... July 9, 2019

LATA 2015 (Nice, France) ..... March 2, 2015

### Seminar

University of Berlin Theory Seminar (Berlin, Germany) ..... August 22, 2025

Oxford University Theory Seminar (Oxford, UK) ..... June 5, 2025

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|-----------------------------------------------------------------------------|---------------------|
| University of Toronto Theory Seminar (Toronto, ON, Canada)                  | May 27, 2025        |
| McGill University Theory Seminar (Montréal, QC, Canada)                     | May 22, 2025        |
| MIT Algorithms and Complexity Seminar (Cambridge, MA, USA)                  | May 14, 2025        |
| University of Copenhagen/Lund University MIAO Seminar (Copenhagen, Denmark) | April 22, 2025      |
| Charles University Theory Seminar (Prague, Czech Republic)                  | April 1, 2025       |
| Max Planck Institute Seminar (Saarbrücken, Germany)                         | February 18, 2025   |
| Universidade de Lisboa TOC Seminar (Lisboa, Portugal)                       | January 15, 2025    |
| University of Austin Theory Seminar (Austin, TX, USA)                       | December 13, 2024   |
| Charles University Theory Seminar (Prague, Czech Republic)                  | November 26, 2024   |
| Czech Academy of Sciences Complexity Seminar (Prague, Czech Republic)       | November 1, 2024    |
| Quantinuum London Research Seminar (London, UK)                             | September 9, 2024   |
| Online Complexity Seminar (Oxford-Warwick) (Zoom)                           | July 26, 2024       |
| Memorial University in Newfoundland Theory Seminar (St. John's, NL, Canada) | February 8, 2024    |
| Institute for Advanced Study CSDM Seminar I (Princeton, NJ, USA)            | January 29, 2024    |
| Columbia University Theory Seminar (New York City, NY, USA)                 | December 1, 2023    |
| McGill University Theory Seminar (Montréal, QC, Canada)                     | November 9, 2023    |
| Online Complexity Seminar (Oxford-Warwick) (Zoom)                           | October 12, 2023    |
| Universidade de Lisboa TOC Seminar (Lisboa, Portugal)                       | October 6, 2023     |
| Oxford University Theory Seminar (Oxford, UK)                               | June 1, 2023        |
| Metacomplexity: CS Conversations (Berkeley, CA, USA)                        | February 1, 2023    |
| Charles University Theory Seminar (Prague, Czech Republic)                  | June 16, 2022       |
| University of Copenhagen/Lund University MIAO Seminar (Zoom)                | September 6, 2021   |
| Institute for Advanced Study CSDM Seminar II (Princeton, NJ, USA)           | December 5, 2017    |
| University of Toronto Theory Student Seminar (Toronto, ON, Canada)          | 2016-2022 (various) |

## RESEARCH VISITS

|                                                                                                           |               |
|-----------------------------------------------------------------------------------------------------------|---------------|
| <b>Oxford University</b>                                                                                  | June 2025     |
| <i>Rahul Santhanam (Oxford University)</i>                                                                |               |
| <b>University of Toronto</b>                                                                              | May 2025      |
| <i>Roei Tell (University of Toronto)</i>                                                                  |               |
| <b>McGill University</b>                                                                                  | May 2025      |
| <i>Robert Robere (McGill University)</i>                                                                  |               |
| <b>Massachusetts Institute of Technology</b>                                                              | May 2025      |
| <i>Ryan Williams (MIT)</i>                                                                                |               |
| <b>Jane Street Graduate Research Fellowship Workshop</b>                                                  | May 2025      |
| <i>Invited research participant with Ted Pyne (MIT)</i>                                                   |               |
| <b>Lund University / Copenhagen University</b>                                                            | April 2025    |
| <i>Susanna de Rezende (Lund University)</i>                                                               |               |
| <b>Max Planck Institute</b>                                                                               | February 2025 |
| <i>Danupon Nanongkai (Max Planck Institute)</i>                                                           |               |
| <b>University of Texas in Austin</b>                                                                      | December 2024 |
| <i>Dana Moshkovitz</i>                                                                                    |               |
| <b>Centrum Wiskunde &amp; Informatica</b>                                                                 | July 2024     |
| <i>Florian Speelman (Universiteit van Amsterdam), Quinten Tupker (Centrum Wiskunde &amp; Informatica)</i> |               |
| <b>Simon Fraser University</b>                                                                            | July 2024     |
| <i>Valentine Kabanets (Simon Fraser University)</i>                                                       |               |

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| <b>Rutgers University - New Brunswick</b> .....                                           | <i>Fall 2023</i>           |
| <i>Michael Saks (Rutgers University), Michal Koucký (Charles University)</i>              |                            |
| <b>McGill University</b> .....                                                            | <i>November 2023</i>       |
| <i>Robert Robere (McGill University), Pierre McKenzie (Université de Montréal)</i>        |                            |
| <b>Universidade de Lisboa</b> .....                                                       | <i>October 2023</i>        |
| <i>Bruno Loff (Universidade de Lisboa)</i>                                                |                            |
| <b>Cambridge University</b> .....                                                         | <i>September 2023</i>      |
| <i>Sergii Strelchuk (Cambridge University), Sathya Subramanian (Cambridge University)</i> |                            |
| <b>University of Warwick</b> .....                                                        | <i>July 2022</i>           |
| <i>Igor Carboni Oliveira (University of Warwick)</i>                                      |                            |
| <b>Charles University</b> .....                                                           | <i>June 2022</i>           |
| <i>Michal Koucký (Charles University)</i>                                                 |                            |
| <b>Columbia University</b> .....                                                          | <i>2021-2024 (various)</i> |
| <i>Toniann Pitassi (Columbia University)</i>                                              |                            |
| <b>Heidelberg Laureate Forum (HLF)</b> .....                                              | <i>September 2019</i>      |
| <i>Invited graduate student participant</i>                                               |                            |
| <b>Heidelberg Laureate Forum (HLF)</b> .....                                              | <i>September 2016</i>      |
| <i>Invited undergraduate student participant</i>                                          |                            |
| <b>Kyoto University</b> .....                                                             | <i>Summer 2015</i>         |
| <i>Kazuo Iwama (Kyoto University)</i>                                                     |                            |

## SERVICE

### ORGANIZING POSITIONS

|                                                                                                                                                                                                                                                     |                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <b>Symposium on the Theory of Computing (STOC'25) Online Poster Session</b> .....                                                                                                                                                                   | <i>June 23, 2025</i>           |
| <i>Charles University</i>                                                                                                                                                                                                                           |                                |
| Proposed, organized, and ran an online poster session as a workshop aimed at inclusion for researchers unable to attend the conference in person, and promoted mixing of junior and senior faculty therein.                                         |                                |
| <b>Computer Science Welfare and Communication Committee (WCC)</b> .....                                                                                                                                                                             | <i>Spring 2023 - Fall 2024</i> |
| <i>University of Warwick</i>                                                                                                                                                                                                                        |                                |
| Represented the postdoctoral researcher community to provide feedback on departmental culture and well-being to prepare a proposal for the Athena SWAN Charter and align department programs to that end.                                           |                                |
| <b>ToniCS: Celebrating the Contributions and Influence of Toniann Pitassi</b> .....                                                                                                                                                                 | <i>March 27-29, 2023</i>       |
| <i>Simons Institute for the Theory of Computing</i>                                                                                                                                                                                                 |                                |
| Proposed the workshop and served as one of the primary organizers on the Organizing Committee. Primary coordinator for the budget and banquet. Coordinated the schedule and solicited invitees and speakers, including almost all student speakers. |                                |
| <b>Special Semester on Metacomplexity</b> .....                                                                                                                                                                                                     | <i>Winter 2023</i>             |
| <i>Simons Institute for the Theory of Computing</i>                                                                                                                                                                                                 |                                |
| Organized the CS Conversations seminar as well as the the social program for the semester. Budgeted and ran all external events, including weekly pub nights, hiking, climbing, board games, and other after hours events.                          |                                |

**Theory Student Seminar**..... *Fall 2018 - Summer 2022*

*University of Toronto*

Organized the weekly student seminar for the theory group, including emails and departmental paperwork/coordination. Overhauled the website to include abstracts, slides, and other reference materials for talks given from 2002 onwards, as well as building tools for future organizers to use in keeping it updated.

**Computer Science Graduate Student Union**..... *Winter 2018 - Summer 2022*

*University of Toronto*

Served in multiple administrative roles, including social coordinator, organizer for the semester-end pub nights, and manager for the building's pop fridge. During the pandemic, organized a number of online events, served as a point of contact for students to the department with regards to financial support, and set up a message forum for the graduate department to use for both work-based and casual discussion.

**Japanese Visual Culture Association**..... *Fall 2012 - Spring 2015*

*Rutgers University*

President during the 2013-2014 school year. Instituted a variety of annual programs, including faculty-led classes on calligraphy, Japanese cooking, costume design, and critical historical analysis of Japanese film. Facilitated outreach activities such as public trivia challenges, as well as contributed video content and information.

## REVIEW WORK

### Program Committee

International Colloquium on Automata, Languages and Programming (*ICALP*)..... 2026

International Symposium on Theoretical Aspects of Computer Science (*STACS*)..... 2026

Latin American Symposium on Theoretical Informatics (*LATIN*)..... 2024

### Journals

SIAM Journal of Computing (*SICOMP*), Computational Complexity, Discrete Optimization, Information and Computation, Information Processing Letters (*IPL*)

### Conferences

Symposium on Theory of Computation (*STOC*), Symposium on Foundations of Computer Science (*FOCS*), Computational Complexity Conference (*CCC*), International Colloquium on Automata, Languages, and Programming (*ICALP*), Innovations in Theoretical Computer Science (*ITCS*), Latin American Theoretical Informatics (*LATIN*), Foundations of Software Technology and Theoretical Computer Science (*FSTTCS*), International Symposium on Mathematical Foundations of Computer Science (*MFCS*), European Symposium on Algorithms (*ESA*), Symposium on Algorithms and Complexity (*CIAC*)

## COMMUNITY SERVICE

**SafeToC**..... *July 2023, June 2024*

*CCC 2023 (University of Warwick), STOC 2024 (Simon Fraser University)*

Served as a point of contact for any potential interpersonal issues throughout the conference.

**Evergreen Forum Tech Assistant**..... *Summer 2021 - Fall 2022*

*Princeton Senior Resource Center*

Ran technical assistance for multiple semester-long weekly lecture series' over Zoom.

**Vaccine Navigator**..... *Spring - Fall 2021*

*Princeton Senior Resource Center*

Tracked and booked vaccine appointments for senior citizens during the COVID-19 epidemic.

# TEACHING

## TEACHING POSITIONS

**Program in Algorithmic and Combinatorial Thinking (PACT)** ..... *Summer 2012 - 2016*  
*Princeton University*

In 2016 gave a weekly lecture series on complexity theory. In previous years graded and assisted with creating assignments for a summer course on discrete mathematics and theoretical computer science, taught by Professor Rajiv Gandhi (Department of Computer Science, University of Pennsylvania). Led discussions on homework and topics covered. Was available for help and information on topics covered in lecture, and on general topics in theoretical computer science.

**Rutgers Young Scholars Program in Discrete Mathematics** ..... *Summer 2014*  
*Rutgers University-New Brunswick*

Oversaw students for a summer course on discrete mathematics aimed at high school students, led by Professor Joseph Rosenstein (Department of Mathematics, Rutgers University-New Brunswick). Assisted with homework and led group discussions about the homework and material covered, gave a lecture on connections between graph theory and theoretical computer science. Evaluated student performance and engagement and communicated with administration about required changes in the course plan.

## LECTURES

### Course lectures

DIMACS REU (Charles University) ..... *July 22, 2025*  
*CSC 2451 - Quantum Computing: Foundations to Frontier (University of Toronto)*.....*December 5, 2018*  
*CSC 2429 - Advanced Data Structures (University of Toronto)*.....*June 11, 2018*  
*CSC 2429 - Proof Complexity, Mathematical Programming, and Algorithms (University of Toronto)*.....*March 24, 2018*  
*Complexity Theory (PACT Program)*.....*Summer 2016 (weekly)*

### About research

Newark Academy (Livingston, NJ, USA) ..... *December 12, 2023*  
Princeton High School (Princeton, NJ, USA) ..... *April 22, 2014*  
PACT Program (Princeton, NJ, USA) ..... *2013, 2014, 2016*

## TEACHING ASSISTANTSHIPS

### University of Toronto

*CSC 2426 - Fundamentals of cryptography (graduate course)* ..... *Fall 2020*  
*CSC 463 - Computational complexity and computability* ..... *Winter 2017, Winter 2018*  
*CSC 373 - Algorithm design, analysis, and complexity* ..... *Summer 2017*  
*CSC 236 - Introduction to the theory of computation* ..... *Fall 2020*  
*CSC 165 - Mathematical expression and reasoning for Computer Science* ..... *various (7 times)*

### Rutgers University-New Brunswick

*CS509 - Foundations of Computer Science (graduate course; grading only)* ..... *Fall 2015*

*Last updated: 17/08/2025*