Kaniuar Bacho

kaniuar.bacho@gmail.com Kaniuar Bacho Website

Education

PhD Quantum Cryptography 2025 - 2027
University of Edinburgh *United Kingdom*

- Awarded full funding for my PhD studies by the University of Edinburgh's School of Informatics
- Research focus: exploring the minimal assumption in quantum cryptography that still ensures a rich family of useful applications
- Advisors: Alexandru Cojocaru & Tomoyuki Morimae

M.Sc. IT Security 2022 - 2024
Ruhr University Bochum *Germany*

- Cumulative GPA: 98%/100% (excellent)
- 95 successful graduations from 2021 to 2024, with 5 of these graduates achieving $\geq 95\%$ (excellent)
- Awarded full funding for my master's studies by the German Academic Scholarship Foundation
- Selected Coursework:
  - ◇ Discrete Mathematics
  - ◇ Information Theory
  - ◇ Introduction to Cryptography I, II
  - ◇ Cryptography
  - ◇ Cryptographic Protocols
  - ◇ Zero-Knowledge Proof Systems
  - ◇ Post-Quantum Cryptanalysis
  - ◇ Quantum Cryptography
  - ◇ Quantum Information & Computation
  - ◇ Quantum Algorithms
  - ◇ Quantum Circuits
- Master's Thesis: Compiling Nonlocal Games without Quantum Homomorphic Encryption (grade 100%)
- Advisors: Michael Walter & Giulio Malavolta

B.Sc. Mathematics 2017 - 2021
University of Bonn *Germany*

- Cumulative GPA: 1.5/1.0 (very good)
- Awarded full funding for my bachelor's studies by the German Academic Scholarship Foundation
- Selected Coursework:
  - ◇ Analysis I, II, III
  - ◇ Complex Analysis
  - ◇ Algorithmic Mathematics I, II
  - ◇ Probability Theory
  - ◇ Markov Chains & Stochastic Algorithms
  - ◇ Geometry and Topology
  - ◇ Linear Algebra I, II
  - ◇ Group, Ring, and Galois Theory
  - ◇ Commutative Algebra
  - ◇ Representation Theory of Lie Algebras
  - ◇ Representation Theory of Groups
  - ◇ Algebraic Number Theory
- Bachelor's Thesis: Classification of Representations of $\mathrm{GL}_2(\mathbb{F}_{p^n})$ (grade 1.1)
- Advisors: Johannes Anschütz & Peter Scholze

Publications & Preprints

Humanity's Last Exam [arXiv] 2025

- Contributed mathematical problems that current LLMs can't solve, establishing a new benchmark to test AI limits

Compiled Nonlocal Games from any Trapdoor Claw-Free Function [ePrint] 2024
Kaniuar Bacho, Alexander Kulpe, Giulio Malavolta, Simon Schmidt, Michael Walter

- QIP 2025 (Poster Presentation)

Talks

Slides of my talks are available at kaniuarbacho.github.io

Compiling Nonlocal Games without Quantum Homomorphic Encryption
- Defense of my Master's Thesis at the Ruhr University Bochum (Dec 2024)

Quantum Error Correction
- Quantum Technologies Academy in Bavaria, Germany (Aug 2024)

Quantum Random Walks
- Quantum Algorithms Seminar at Ruhr University Bochum (Jul 2023)

Quantum Key Distribution
- Department-wide presentation at the company 'TÜV Information Technology' (Oct 2022)

Quadratic Forms over $\mathbb{Q}_p$
- Algebraic Number Theory Seminar at the University of Bonn (Nov 2020)

Classification of Representations of $\mathrm{GL}_2(\mathbb{F}_{p^n})$
- Defense of my Bachelor's Thesis at the University of Bonn (Sep 2020)

Representation Theory of Lie Algebras
- Lie Algebras Seminar at the University of Bonn (May 2020)

Random Walks on the Symmetric Group
- Markov Chains and Stochastic Algorithms Seminar at the University of Bonn (Jul 2018)

Work Experience

Quantum Cryptography Researcher Jan 2025 - Dec 2027
Quantum Software Lab

Quantum Technologies Intern Sep 2022
TÜV Information Technology
- Consulted institutes on securing their Quantum Key Distribution setups against attack vectors
- Presented a department-wide introduction on BB84 and contemporary side-channel attacks on QKD devices

Teaching Assistant
Ruhr University Bochum & University of Bonn
- Held weekly tutorials, corrected homework, and created and graded exams
- Quantum Information and Computation (Winter 2023/2024)
- Cryptographic Protocols (Summer 2023)
- Analysis II (Summer 2019): the professor and my students graded my teaching with a 1.0/1.0

Volunteer Mentor for Freshmen Oct 2019 - Sep 2020
University of Bonn
- Mentored freshmen by providing tips on how to learn, think, and solve problems, and answered all kinds of questions

Visiting Researcher Sep 2018
Max Planck Institute for Mathematics
- Falsified a conjecture in Algebraic Topology by constructing an explicit counterexample

Honors & Awards

International Olympiad in Cryptography Dec 2023
- Silver Medalist: ranked 3rd in the 'University Students' category (200 competitors)
- 2 out of 8 of my solutions were selected as the best solutions

German Academic Scholarship Foundation
- Awarded full funding for my bachelor's and master's studies (Top 0.5% students in Germany)

- Germany's largest, oldest and most prestigious scholarship foundation

International Mathematical Olympiad - Germany Team Selection Test 2014 - 2017

Federal Mathematics Competition [my write-ups] 2016 - 2017

- Two-time national winner 2016 & 2017 (Top 0.5% of 1,500 competitors)
- Most prestigious mathematical competition in Germany, alongside the Mathematical Olympiad
- Interviewed on the German TV show 'WDR' and the radio

German Mathematical Olympiad 2010 - 2016

- Several first prizes in the first three rounds (5^{th} grade to 11^{th} grade)
- Team member representing the German state of NRW for the finals (DeMO) in 2016 (Top 0.1% of 200,000 competitors)

Mathematical Kangaroo 2016

- First Prize (Top 0.35% of 10,500 competitors at my grade level in Germany)

Vice Boxing Champion of North Rhine-Westphalia Germany 2015

Projects

Machine Learning for Trading 2023

- Course by Prof. Dr. Tucker Balch, Managing Director at J.P. Morgan AI Research
- Implemented machine learning-based strategies in Python to make trading decisions using real-world data

Skills

Programming	Python, C++, HTML/CSS, Z Shell, Git, Machine Learning for Trading
Languages	German & Kurdish (both native), English (TOEFL Score 103)