Marko Brnović

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Research statement: I am broadly interested in quantum information and quantum computing. My research focus is on mathematical and computational aspects of quantum double models and their applications to fault-tolerance.

Education and Honours

- **Dipartimento di Fisica e Astronomia "Augusto Righi", Universitá di Bologna** — Bologna, Italy
  PhD Theoretical Physics — *Nov 2024 - present*
  Honours: *Marie Curie Doctoral Fellow, funded by MSCA CaLiForNIA*
- **Perimeter Institute for Theoretical Physics & University of Waterloo** — Waterloo, Ontario
  MSc Theoretical Physics — *Sep 2023 - Aug 2024*
  Honours: *Perimeter International Scholar, Mitacs Internship Award*
- **New York University Abu Dhabi** — Abu Dhabi, United Arab Emirates
  BSc Physics (Cum Laude), BSc Mathematics (Cum Laude) — *Sep 2018 - May 2022*
  Honours: *Full Scholarship, University Honors Scholar, Founders' Day Award, Post-Graduation Research Fellowship*

Experience

- **DIFA, Universitá di Bologna** — Bologna, Italy
  PhD researcher — *Nov 2024 - present*
  - **Studying quantum double models of finite groups** and their applications to lattice gauge theories
  - **Studying error-correcting properties** of quantum double models
- **PIQuIL Laboratory, Perimeter Institute for Theoretical Physics** — Waterloo, Ontario
  Researcher under Dr. Roger Melko, funded by Mitacs — *Nov 2023 - Oct 2024*
  - **Designing, implementing and benchmarking** summary descriptors and metrics characterising both the parametrized quantum circuit (PQC) ansatz and target circuit (TC)
  - **Developed PQC's with efficient gradient estimation** in collaboration with the company HAIQU
- **Perimeter Institute for Theoretical Physics, Winter School** — Waterloo, Ontario
  Researcher under Dr. Sung-Sik Lee and Dr. Han Ma — *Nov 2023 - June 2024*
  - **Using a field-theoretic functional renormalization group scheme** to examine the collective modes in metals tuned to a topological quantum criticality
  - **Studying scattering processes** at a Van Hove singularity
- **New York University Abu Dhabi, Kirmizialtin Laboratory** — Abu Dhabi, United Arab Emirates
  Post Graduation Research Fellow in Physics — *Aug 2022 - Sep 2023*
  - **Developed a mathematical model** that supports like-charge attraction of charge-correlated biopolymers
  - **Investigated a phase transition of biopolymer length** depending on the level of crowding in the environment, by means of molecular simulations and mathematical modelling
- **New York University Abu Dhabi** — Abu Dhabi, United Arab Emirates
  Research Assistant under Dr. Serdal Kirmizialtin and Dr. Francesco Paparella — *May 2021 - July 2022*
  - **Computationally constructed free-energy surface profiles** of biopolymer system in divalent cationic solutions
  - **Co-developed** a Python-based numerical simulation of a Rayleigh-Bénard convection cell
  - **Wrote a research paper** on investigating biomolecular interactions via molecular dynamics simulations

Posters and Presentations

- **Perimeter Institute for Theoretical Physics** — Waterloo, Ontario, Canada
  MSc Student, Research Intern — *2023 - 2024*
  - **"Efficient Training of Layerwise-Commuting PQCs with Parallel Gradient Estimation"** - Poster, IEEE International Conference on Quantum Computing and Engineering with Dmitri Iouchtchenko, Maciej Koch-Janusz
  - **"Benchmarking Parameterised Quantum Circuits"** - Presentation, MSc Defence
  - **"Collective Modes in Topological Critical Metals"** - Presentation, Winter School Research Project with Nikhil Nair, Sung-Sik Lee, Han Ma
- **New York University Abu Dhabi** — Abu Dhabi, United Arab Emirates
  BSc Student, Research Fellow — *2022-2023*
  - **"Length Dependent DNA Dynamics in Crowded Environments"** - Poster, GPPO Research Conference
  - **"Induced Ion Correlations Lead To DNA Attraction In Manganese"** - Poster, BPS Annual Meeting, San Diego
  - **"Modelling a Free-moving Raft on a Rayleigh-Bénard Convection Cell"** - Presentation & Poster, BSc Defence

Skills & Interests

- **Languages** Montenegrin (Native), English (Fluent), Spanish (Intermediate), Italian (Beginner)
- **Softwares** Python (Qiskit, PyTorch, scikit, scipy, manim), MATLAB, Julia, GROMACS, Mathematica
- **Interests** Quantum Computing, Machine Learning, Water Polo, Swimming, Basketball, Triathlon, Guitar
- **Soft Skills** Simulations, Graphic Design, Languages, Leadership, Teamwork, Public Speaking