Michael de Oliveira

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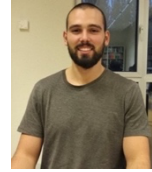
Resume & Research Focus

I am a Ph.D. candidate at the INL, specializing in quantum circuit synthesis and complexity. My research focuses on identifying and proving quantum computational advantage, particularly in scenarios suited to near-term devices. Additionally, I have worked on to the development of quantum algorithms in industry settings through a research role at Foxconn and an internship at IBM.

Current Position

International Iberian Nanotechnology Laboratory, INL (Braga, Portugal) – PhD candidate in Computer Science (Sep 2021 – Sep 2025) with Professor Elham Kashefi and Professor Ernesto Galvão

Education & Work Experience

IBM (Cambridge, MA) – Quantum Computing Theory Research Scientist (May 2025 – Aug 2025)

Foxconn (Taiwan)– Part-time Quantum Computing Researcher (Sep 2024 – Apr 2025)

Sorbonne University (Paris, France) – Visiting PhD student (Oct 2022 – Aug 2024)

University of Minho (Braga, Portugal) – B.Sc. Engineering Physics & M.Sc. Quantum Computing

- 18/20, A on the ECTS scale; Excellence award 2nd & 3rd year of B.Sc. & 1st year of M.Sc.

Selected Publications, Pre-prints & Presentations

📄 **Unconditional adv. of noisy qudit q. circuits over biased threshold circuits in constant depth**

📌 Proves an unconditional quantum advantage for shallow-depth circuits over expressive classical models, including certain neural networks. Covers all qudit dimensions, includes surface-code-based noise robustness, and analyzes resource requirements for physical implementation.

📇 Nature Communications 🎙 **Talk** –TQC24 ; 🎙 **Talk** – QPL24 ; 📢 Foxconn ; 📢 INL

📄 **Heuristic-free verification-inspired quantum benchmark.**

📌 Proposes the first formal quantum benchmark certifying the correctness of quantum circuits solving decision problems—recently demonstrated on Quantinuum's H1 device.

📇 Quantum Science and Technology; 🎙 **Talk** – DPG24; 🖼 **Poster** – QCTiP24; 📢 INESC

📄 **Quantum advantage in temporally flat measurement-based quantum computation.**

📌 Introduces new circuits synthesis techniques for non-adaptive MBQC, achieving exponential resource reductions over prior methods, with detailed quantum–classical gate count comparisons

📇 Quantum Journal; 🎙 **Talk** – AQIS23; 🖼 **Poster** – TQC23

Technical Skills

P.L. & Software: **Python**, Numpy, Matplotlib, **Wolfram Mathematica**, **C**, Haskell, Erlang, **Qiskit**.

Prizes

🏆 **"New Talents in Quantum Tech."** – Gulbenkian Foundation (1 of 8 recipients nationally that year).

Teaching

"Advanced Quantum Information Processing", Masters in Quantum Information at Sorbonne University

Reviewer

Nature Communications (**Nat.Comm.**); Computational Complexity Conference (**CCC22**); IEEE QSW 2024; Quantum Information Processing (**QIP23**); Young Quantum Information Science (**YQIS24**);

Supervision

Master thesis "Quantum Bayesian Reinforcement Learning" (20/20) – Gilberto Cunha 2022

+ Publications, Pre-prints

The power of shallow depth Toffoli and qudit quantum circuits.

ACM Transactions on Quantum Computing (under rev.); **Poster** – QCTiP24 & TQC24

Quantum Bayesian Decision Making (algorithm)

Foundations of Science; **Talk** – WOE20

Research Visits

Visiting Researcher – Technical University Munich (19-25/06/2023) with Professor Robert König.

Visiting Researcher – University of Innsbruck (4-11/12/2023) with Professor Hans Briegel.

+ Scientific outreach

Invited Speaker – "Temporally unstructured measurement-based quantum computation with advantage", Quantum software lab workshop, Edinburgh, Scotland

Invited Speaker – "On the computational power of commuting and non- commuting operations for quantum processes", VeriQloud, France

Talk – "Quantum online planning for POMDPs with Bayesian Networks"; Quantum Information and Probability: from Foundations to Engineering Conference (QIP22)

Talk – "Simulation of Quantum measurements with a gate-by-gate strategy"; INL Seminars

Additional Training

IBM – Quantalab School on Quantum Computing 2018, INL

Course – "Introduction to Quantum Logic: Mathematical, Physical and Computational aspects ", Instituto de Filosofía y Ciencias de la Complejidad, Chile; lectured by Professor Karl Svozil