Jeffrey Morais
Quantum computing theorist

Website Email
LinkedIn Github

Educational Background

Fall 2024 **M.Sc. Physics**, *University of Victoria*, Victoria, Canada

- Thesis on quantum virtual cooling via many-body holographic systems.
- Scholarships: NSERC CREATE Quantum Computing Program, BCGS ($30,500)

2019 - 2023 **B.Sc. Honours Physics**, *McGill University*, Montréal, Canada (GPA: 3.84/4.0)

- Thesis on de Sitter space compactifications in type II string theory and M-theory.
- Scholarships: 2 NSERC USRAs with FRQNT, SURA, SURE, BSA ($41,600)

Selected Experience

Summer 2023 **Quantum Computing Theorist**, *University of Alberta*, Edmonton, Canada

- **Demonstrated a novel relationship between topological wormholes and quantum tunnelling** for systems of entangled qubits in potential-well lattices.
- Characterized the general entanglement structure of confined qubits which enabled **quantum algorithms to run 2x more efficiently**.
- Computed non-perturbative, non-local corrections to the qubit path integral, allowing for **measuring quantum observables with more accuracy**.

Supervisor: Prof. Igor Boettcher

Summer 2022 **String Cosmology Theorist**, *McGill University*, Montréal, Canada

- **Increased efficiency of extracting cosmic string signals by 1.7x** within non-linear noise, allowing for sampling much larger areas with **wavelet/match filter statistics**.
- Created the cosmic string signal and **developed numerical algorithms** in **Python** to recognise its profile with **45% more accuracy than previous statistics** with correlation functions.
- Classified the stability of the cosmic strings to **constrain the signal distribution in the expanding spacetime**.

Supervisor: Prof. Robert Brandenberger

Fall 2021 **Quantum Cosmology Data Scientist**, *McGill University*, Montréal, Canada

- **Developed computational methods in Python** for decoupling the fast radio burst signals from noise for describing black-white wormhole tunneling events.
- **Coordinated with 10+ physicists at Compute Canada Cedar** to optimize the calculation of scintillation and decorrelation bandwidths of the burst via **bash scripts**.
- **Established a method for finding the position of the bursts** using spatial correlation functional defined in the our universe's spacetime.

Supervisor: Prof. Victoria Kaspi

2019 - 2020 **Quantum Theorist**, *Vanier College*, Montréal, Canada

- **Developed a novel approach to solve non-linear PDE** Hamilton-Jacobi equations of motion and generated quantum trajectories in pilot-wave theory.
- Developed efficient **real-time simulations of quantum trajectories with recurrent neural networks in Python** for arbitrary potentials.

Supervisor: Prof. Ivan Ivanov

Ongoing Experience

Present **Post-Quantum Cryptography Intern**, *BTQ*, Vancouver, Canada

- Using persistent homology and topological data analysis techniques **to make consensus protocols more robust in post-quantum cryptographic applications**.
- We characterize the autonomous evolution and interaction of consensus networks by studying their topology at different grained length scales.

Collaborators: Prof. Gavin Brennen, Dr. Peter Rohde

Present **Quantum Neural Network Theorist**, *Fudan University*, Shanghai, China

- Using topological quantum neural networks to **address the issue of generalization in deep neural networks and make quantum algorithms more efficient**.
- We characterize the networks with the use of topological quantum field theory, a framework which more **efficiently transcribes the information required for quantum tasks in quantum computers**.

Supervisor: Prof. Antonino Marcianò, Prof. Emanuele Zappala