Pedro Figueroa–Romero

01/2025

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Experience

IQM Quantum Computers — *Munich, Germany.*

10/2024 to Present — *Senior Quantum Engineer*
05/2022 to 09/2024 — *Quantum Engineer*

- Quantum Characterization, Verification and Validation (QCVV) theory and implementation.
- Scientific research, collaborative coding, technical guidance and mentoring, and advising strategic decisions regarding full-stack benchmarks and benchmarking standards.
- Led the establishment of a QCVV software suite (open-sourced in 12/2024 as IQM Benchmarks) and a respective roadmap for IQM from Noisy Intermediate regime to Fault Tolerance.
- Version control with Gitlab: bug tracking, software requests, task management and documentation.
- Author in 4 scientific articles and main inventor in 1 filed patent application.

Foxconn Technology Group — *Taipei, Taiwan.*

03/2021 to 04/2022 — *Postdoctoral Research Associate*

- Research on characterization and benchmarking of quantum devices with temporally-correlated noise.

Monash University — *Melbourne, Australia.*

04/2017 to 02/2021 — *Doctoral Researcher*

- Research on the emergence and typicality of memorylessness in quantum stochastic processes.

Education

Monash University — *Melbourne, Australia.*

04/2017 to 02/2021 — *PhD in Science (Quantum Information Science - Theory)*
Thesis: *Equilibration and typicality in quantum processes*
Supervision: Prof. Kavan Modi and Dr. Felix A. Pollock.

The University of Edinburgh — *Edinburgh, Scotland.*

09/2015 to 09/2016 — *MSc in Mathematical Physics*
Dissertation: *Feynman diagram generation for color-kinematics duality*
Supervision: Prof. Donal O'Connell.

Universidad Autónoma Metropolitana — *Mexico City, Mexico.*

09/2010 to 09/2014 — *BSc in Physics* (Licenciatura en Física)
Dissertation: *La geometría de los espacios (A-)dS*
Supervision: Prof. Román Linares Romero.

Patents

(1) P. Figueroa-Romero, *Scalable estimation of noise coherence*. PCT/EP2024/051822, filed 25/01/2024. Patent pending.

(2) M. Papič (10%), P. Figueroa-Romero (10%) & A. Calzona (80%), *Multi-layer Cycle Benchmarking for Efficient Noise Characterization*. FI20240011, filed 28/02/2024. Patent pending.

Research Articles

[1] A. Calzona, M. Papič, P. Figueroa-Romero & Adrian Auer, *Multi-Layer Cycle Benchmarking for high-accuracy error characterization* (2024). arXiv:2412.09332 [quant-ph].

[2] P. Figueroa-Romero, M. Papič, A. Auer, & I. de Vega, *Estimating the coherence of noise in mid-scale quantum systems* (2024). arXiv:2409.02110[quant-ph].

[3] L. Abdurakhimov et al., *Technology and performance benchmarks of IQM's 20-qubit quantum computer* (2024). arXiv:2408.12433[quant-ph]

[4] P. Figueroa-Romero, M. Papič, A. Auer, M.-H. Hsieh, K. Modi & I. de Vega, *Operational Markovianization in randomized benchmarking*. Quantum Sci. Technol. 9 035020 (2023).

[5] N. Dowling, P. Figueroa-Romero, F. A. Pollock, P. Strasberg & K. Modi, *Relaxation of multitime statistics in quantum systems*. Quantum 7, 1027 (2023).

[6] N. Dowling, P. Figueroa-Romero, F. A. Pollock, P. Strasberg & K. Modi, *Equilibration of non-Markovian quantum processes in finite time intervals*. SciPost Phys. Core 6, 043 (2023).

[7] S.-X. Yang, P. Figueroa-Romero & M.-H. Hsieh, *Machine learning of average non-Markovianity from randomized benchmarking* (2022). arXiv:2207.01542[quant-ph].

[8] P. Figueroa-Romero, K. Modi, & M.-H. Hsieh, *Towards a general framework of Randomized Benchmarking incorporating non-Markovian Noise*. Quantum **6**, 868 (2022)..

[9] P. Figueroa-Romero, K. Modi, R. J. Harris , T. M. Stace & M.-H. Hsieh, *Randomized benchmarking for non-Markovian noise*. PRX Quantum **2**, 040351 (2021).

[10] P. Figueroa-Romero, *Equilibration and typicality in quantum processes*. Monash University - Doctoral Thesis (2021).

[11] P. Figueroa-Romero, F. A. Pollock & K. Modi, *Markovianization with approximate unitary designs*. Commun. Phys. **4**, 127 (2021).

[12] P. Figueroa-Romero, K. Modi & F. A. Pollock, *Equilibration on average of temporally non-local observables in quantum systems*. Phys. Rev. E **102**, 032144 (2020).

[13] P. Figueroa-Romero, K. Modi & F. A. Pollock, *Almost Markovian processes from closed dynamics*. Quantum 3, 136 (2019).

Main Computer Software Experience and Usage

Quantum Environment: Qiskit, mainly at circuit and algorithm level.
Programming and Analytics: Python. Version control through Gitlab.
CAS: Wolfram Mathematica.

Certifications

06/2021 — *IBM Exploratory Data Analysis for Machine Learning*, Coursera.
12/2020 — *IBM Quantum Challenge Foundational*, IBM.
08/2020 — *Python Basic*, Hackerrank.

Supervision and Teaching Experience

Supervision at Foxconn Technology Group (Quantum Computing Research Center)
09/2021 to 04/2022 — Leading project on *Machine Learning with Tensor Network Techniques for Randomized Benchmarking* with Mr. Shih-Xian Yang (currently PhD candidate at INFN, Bari, Italy).

Teaching Associate at Monash University: tutoring, planning and marking
04/2020 to 07/2020 — PHS1001 *Foundation Physics*.
08/2019 to 11/2019 — PHS3101 (s2) *Statistical and condensed matter physics*.
03/2019 to 06/2019 — PHS3101 (s1) *Quantum Mechanics*.

08/2018 to 11/2018 — PHS3062 *Fundamental particle physics*.
03/2018 to 06/2018 — PHS2061 *Quantum and thermal physics*.
08/2017 to 11/2017 — PHS3062 *Fundamental particle physics*.

Awards and Honours

2021 — *Outstanding paper award*, Foxconn Education Foundation.
2017/2020 — MGS and MIPRS scholarships at Monash University.
2015/2016 — *Becas Conacyt al extranjero*, Mexican Sciencie Council scholarship for MSc studies.
2015 — *Medalla al Mérito Universitario* (highest average grade honor), UAM-I, Mexico City.
2013 — *Academic Excellence*, Secretaría de Educación Pública, Mexico City.

Events — Participation / Organization / Presentation

04/2024 — *Poster presentation*, QCTiP24, The University of Edinburgh. Edinburgh, UK.
06/2023 — *Guest Talk*, TU Hamburg, Germany.
03/2023 — *APS March Meeting 2023* (presentation), Las Vegas, USA.
04/2022 — *Guest Talk* (online presentation), Forschungszentrum Jülich, Germany.
03/2022 — *Guest Talk*, NCKU, Taiwan.
03/2022 — *QIP 2022* (online presentation), Caltech, USA.
10/2021 — *Guest talk* (online presentation), QICI, The University of Hong Kong.
10/2021 — *BIID'9* (organizing committee member and online presentation), NTU, Taiwan.
09/2021 — *AQIS 2021* (online presentation), U. Tokyo, Japan.
09/2021 — *Guest talk* (online presentation), CQSE, NTU, Taiwan.
08/2021 — *Guest talk* (online presentation), Photon Science Center, U. Tokyo, Japan.
07/2021 — *TQC 2021* (session chair, online presentation), University of Latvia.
04/2021 — *Guest talk*, (online presentation) Universidade Federal Fluminense, Brazil.
10/2020 — *Quantum Thermodynamics of Non-Equilibrium systems* (online presentation), DIPC.
12/2019 — *AIP Summer Meeting* at RMIT. Melbourne, Australia.
11/2019 — *Qiskit Camp Asia* at IBM Tokyo Labs (hackathon participation). Tokyo, Japan.
07/2019 — *Guest talk and group visit* at Trinity College Dublin. Dublin, Ireland.
06/2019 — *Conference on Taming Non-Equilibrium Systems* at ICTP. Trieste, Italy.
06/2018 — *Quantum Thermodynamics Conference* at KITP, UC Santa Barbara. California, USA.
01/2018 — *Sydney Quantum Information Theory Workshop* at Coogee Bay. Sydney, Australia.
04/2016 — *QCD meets gravity* at The University of Edinburgh. Edinburgh, UK.
07/2014 — *5th Summer School on Mathematics*, CIMAT. Guanajuato, Mexico.
07/2014 — *Workshop on Soft Matter, Hard Matter and Dark Matter*, UAM-I. Mexico City, Mexico.
01/2014 — *6th Colloquium of the Mathematics Department*, UAM-I. Puebla, Mexico.
06/2013 — *School on Mathematical Modelling/Numerical Methods*, CIMAT. Guanajuato, Mexico.

Languages

Spanish (native), English (fluency), German (B1/intermediate), French (B1/intermediate).