

# Felipe Montealegre-Mora, Dr.

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🌐 [Personal Webpage](#)

🌐 [Google Scholar](#), [LinkedIn](#)

## Education and Employment

- 2022 - Present    📌 **Postdoctoral researcher, UC Berkeley** on computational ecology. Focus on data science and machine learning applications to ecological management and forecast. Research group: Carl Boettiger.
- 2022    📌 **Postdoctoral researcher, University of Cologne** on theoretical physics. Brief post-doc appointment focused on finishing ongoing research projects and on teaching. Research group: David Gross.
- 2018 – 2022    📌 **Ph.D., University of Cologne**, theoretical physics. Grade: 0.7 (*magna cum laude*). Thesis title: *Stabilizer and numerical representation theory: dualities, algorithms and applications*. Research group: David Gross.
- 2015 – 2017    📌 **M.Sc. Physics, University of Cologne**, theoretical physics. Grade: 1.2 (*very good*). Thesis title: *Contextuality and negative quasi-probability in qubit phase space*. Research group: David Gross.
- 2010 – 2015    📌 **B.Sc. Physics, University of Costa Rica**.

## Skills

- Languages    📌 Spanish (*native*), English (*very good*), German (*good*).
- Coding    📌 (*Very good*) Python.  
(*Good*) R, C++, Matlab, GAP Computational Discrete Algebra.

## Publications

### Journal Articles

- 1    Haferkamp, J., **Montealegre-Mora, F**, Heinrich, M., Eisert, J., Gross, D., & Roth, I. (2022). Efficient unitary designs with a system-size independent number of non-clifford gates. *Communications in Mathematical Physics*, 1–47. Available at [arXiv:2002.09524](#).
- 2    **Montealegre-Mora, F.**, & Gross, D. (2022). Duality theory for clifford tensor powers. [arXiv:2208.01688](#).
- 3    Heimendahl, A., **Montealegre-Mora, F.**, Vallentin, F., & Gross, D. (2021). Stabilizer extent is not multiplicative. *Quantum*, 5, 400. [Open access](#).
- 4    **Montealegre-Mora, F.**, & Gross, D. (2021). Rank-deficient representations in the Theta correspondence over finite fields arise from quantum codes. *Representation Theory of the American Mathematical Society*, 25(8), 193–223. [Open access](#).
- 5    **Montealegre-Mora, F.**, Rosset, D., Bancal, J.-D., & Gross, D. (2021). Certifying numerical decompositions of compact group representations. [arXiv:2101.12244](#).
- 6    Rosset, D., **Montealegre-Mora, F.**, & Bancal, J.-D. (2021). Replab: A computational/numerical approach to representation theory. In P. M.B., M. R., T. Z., W. P., & W.-K. W. (Eds.), *Quantum Theory and Symmetries: Proceedings of the 11th International Symposium, Montreal, Canada* (pp. 643–653). Available at [arXiv:1911.09154](#). Springer.




- 7 Vargas, W. E., Azofeifa, D. E., Clark, N., Solis, H., **Montealegre-Mora, F.**, & Cambronero, M. (2014). Parametric formulation of the dielectric function of palladium and palladium hydride thin films. *Applied optics*, 53(24), 5294–5306.

## Outreach Articles

- 1 **Montealegre-Mora, F.** (2020). Randomness and the beast (in quantum computing). <https://manybodyphysics.com/2020/07/12/randomness-and-the-beast-in-quantum-computing/>.

## Experience



### Programming

- 2022 -Present  **gym\_fishing**, a Python module for training deep reinforcement learning on ecologically-inspired control problems. (*Main developer on unpublished branch focused on complex multi-species ecosystems.*)
- 2020 - 2022  **RepCert**, a Python suite for the certification of numerical representation decompositions. (*Main developer.*) Available at: <https://github.com/felimomo/RepCert>
- 2014  **GModelSST**, C++ code predicting the influence of accretion-disk g-modes on observations of the large synoptic survey telescope (LSST). (*Main developer.*) Available on request.


### Thesis Co-Supervision

- Master's  **t-copy representation of the n-qudit Clifford group.** Angelos Bampounis, University of Cologne 2020. (Jointly with David Gross.)
-  **Studying Stabilizer de Finetti Theorems and Possible Applications in Quantum Information Processing.** Paula Belzig, University of Cologne and ETH Zurich 2020. (Jointly with David Gross, Mariami Gachechiladze and Joe Renes.)
- Bachelor's  **A study of the matrix group spanned by anti-identity matrices.** Felix Höddinghaus, University of Cologne 2022. (Jointly with David Gross.)
-  **Is state independent contextuality (SIC) typical for few qubits?** Tobias Hartmann, University of Cologne 2020. (Jointly with David Gross.)
-  **Parametric noise on qubit Hamiltonians.** Stefan Schmitz, University of Cologne 2019. (Jointly with David Gross.)

### Volunteer Work

- 2023  Volunteer at the **Western Service Workers Association (WSWA)**. Activities include organizing community-building events, coordinating labor solidarity initiatives, canvassing and phone banking.
- 2021  Faculty of Science representative and co-founder of international working group at the **Black, Indigenous and People of Color Organization (BIPoC Referat)**, University of Cologne. (*Supports and provides assistance to victims of discrimination, promotes empowerment and community-building through e.g. workshops and lecture series.*) <https://bipoc.uni-koeln.de>

### Conference Organization


- 2018  **Discrete Phase Space Methods for Quantum Fault Tolerance**, DPG Physics Center Bad Honnef, 08.2018. (Jointly organized with David Gross and Markus Heinrich.) <http://phasespace.uni-koeln.de>

## Experience (continued)

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- 2017-2020     **Rhineland Quantum Information Network Spring Meetings**, University of Cologne, 06.2017, 06.2018, 03.2020. (Jointly organized with David Gross and Markus Heinrich.)  
<http://www.quantum-rhineland.net>

## Experimental Physics

- 2013-2015     Research assistant at **CICIMA, University of Costa Rica**. Atomic force microscopy, ultra-high vacuum equipment, thin film optics.

## Grants Received

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- 2016     Travel grant from the Bonn-Cologne Graduate School of Physics and Astronomy to attend *2nd IMSc School on Quantum Information*, hosted at the Institute of Mathematical Sciences, Chennai, India. (December 2016)
- 2023     Travel grant from the ESIL institute to attend the *ESIL Summit*, hosted at UC Boulder, Colorado. (May 2023)