

Felipe Montealegre, PhD

✉ fmonteal@thp.uni-koeln.de

🌐 [Personal Webpage](#)

🌐 [Google Scholar](#), [LinkedIn](#)

Education

- 2022 – Present **Postdoctoral researcher, University of Cologne.** Brief postdoc appointment focused on finishing ongoing research projects and on teaching. *Expected end of appointment: July 31st, 2022.*
- 2018 – 2022 **Ph.D., University of Cologne** in theoretical physics. Grade: 0.7 (*magna cum laude*)
Thesis title: *Stabilizer and numerical representation theory: dualities, algorithms and applications.* Defended: March 3rd, 2022.
- 2015 – 2017 **M.Sc. Physics, University of Cologne** in physics.
Grade: 1.2 (*very good*)
Thesis title: *Contextuality and negative quasi-probability in qubit phase space.*
- 2010 – 2015 **B.Sc. Physics, University of Costa Rica.**

Skills

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

Publications

Journal Articles



- 1 Heimendahl, A., **Montealegre-Mora, F.**, Vallentin, F., & Gross, D. (2021). Stabilizer extent is not multiplicative. *Quantum*, 5, 400. [Open access](#).
- 2 **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](#).
- 3 **Montealegre-Mora, F.**, Rosset, D., Bancal, J.-D., & Gross, D. (2021). Certifying numerical decompositions of compact group representations. [arXiv:2101.12244](#).
- 4 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.
- 5 Haferkamp, J., **Montealegre-Mora, F.**, Heinrich, M., Eisert, J., Gross, D., & Roth, I. (2020). Quantum homeopathy works: Efficient unitary designs with a system-size independent number of non-Clifford gates. [arXiv:2002.09524](#). (*Presented at QIP 2021 conference, acceptance rate < 16%*.)
- 6 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

- 2020-  **RepCert**, a Python suite for the certification of numerical representation decompositions. Algorithms discussed theoretically in *arXiv:2101.12244*. 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). 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.)


Student Organization

- 2021  Faculty of Science representative and co-founder of international working group at the **Black, Indigenous and People of Color Organization**, 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>
- 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

- 2016  Travel grant from the Bonn-Cologne Graduate School of Physics and Astronomy to attend *2nd ISc School on Quantum Information*, Institute of Mathematical Sciences, Chennai, India.

References

- Prof. David Gross, University of Cologne, Germany. *Thesis advisor.*
david.gross@thp.uni-koeln.de
- Dr. Jean-Daniel Bancal (PI), Univeristé Paris-Saclay. *Research collaborator.*
jdbancal.physics@gmail.com

Outside Academia

- Music
- I'm passionate about music, I've played guitar and percussion in a few bands. Up until Covid hit I was part of a cover band playing a nice mix of funk, rock and latin rythms.
 - Throughout the several stages of the lockdown, me and my housemates played rebetiko – a greek style of music – under the bandname of Nik and Mortes. Check us out!
[Nik and Mortes - Se ksehasa den se pono / Still Dre](#)
 - Recently I started making theme songs for pixelated photos of my friends (inspired by [this classic](#)). Here's the first one: [LoLo's Cat Theme Song](#).