

Zacharie Van Herstraeten

Quantum information & optics researcher

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Employment

- 2024 – Now 📌 **Postdoctoral researcher** 📍 Paris, France
Inria — École Normale Supérieure (ENS)
Postdoctoral research in the QAT team with Dr. Ulysse Chabaud, employing phase-space methods to identify and characterize quantum resources.
- 2022 – 2024 📌 **Postdoctoral researcher** 📍 Tucson, AZ, USA
College of Optical Sciences, University of Arizona
Postdoctoral research in the Quantum Photonic Applications Group of Prof. Saikat Guha, focusing on quantum communication with continuous-variable systems

Education

- 2017 – 2021 📌 **PhD in Quantum Information** 📍 Brussels, Belgium
École polytechnique de Bruxelles, Université libre de Bruxelles (ULB)
Doctoral research conducted at the Center for Quantum Information and Communication (QulC), under the supervision of Prof. Nicolas J. Cerf.
- 2015 – 2017 📌 **Msc in Physics Engineering** 📍 Brussels, Belgium
École polytechnique de Bruxelles, Université libre de Bruxelles (ULB)
Specialized in photonics and quantum applications.
- 2015 – 2016 📌 **International exchange** 📍 Trondheim, Norway
Norwegian University of Science and Technology (NTNU)
First year of the master's degree completed as part of the Erasmus program.
- 2012 – 2015 📌 **Bsc in Engineering** 📍 Brussels, Belgium
École polytechnique de Bruxelles, Université libre de Bruxelles (ULB)
General engineering curriculum.

Volunteer

- 2025  **Co-organizer**  Paris, France
QuiDiQua — Quasiprobability Distributions in Quantum Mechanics, Optics and Information
Member of the organizing committee of the international conference QuiDiQua 3 (Paris, 2025), focusing on quasiprobability distributions and phase-space methods.
- Since 2025  **Package maintainer**
qopy — Quantum Optics in Python
Developer and maintainer of an open-source Python toolkit for Wigner functions, bosonic channels, and visualization in quantum optics. Available at: github.com/zac-vh/qopy
- Since 2024  **Reviewer**
Peer-reviewed scientific journals
Reviewer for various journals in quantum information and quantum physics: *Quantum*; *Physical Review A*; *Quantum Information Processing*; *International Journal of Theoretical Physics*.
- 2017 – 2021  **Teaching assistant**  Brussels, Belgium
École polytechnique de Bruxelles, Université libre de Bruxelles (ULB)
Taught exercise sessions and lectures in the quantum mechanics course for third-year engineering students. Supervised the master's theses of two students.

Publications

Preprints

- 1 T. Upadhyaya, **Z. Van Herstraeten**, J. Davis, O. Hahn, N. Koukoulekidis, and U. Chabaud, "Majorization theory for quasiprobabilities," Jul. 2025. arXiv: 2507.22986 [quant-ph].
- 2 **Z. Van Herstraeten** and N. J. Cerf, "Wigner entropy conjecture and the interference formula in quantum phase space," Nov. 2024. arXiv: 2411.05562 [quant-ph].

Journal papers

- 1 A. J. Pizzimenti, P. Dhara, **Z. Van Herstraeten**, S. Cheng, and C. N. Gagatsos, "Exploring the possibility of a complex-valued non-Gaussianity measure for quantum states of light," *APL Quantum*, vol. 1, no. 3, Sep. 2024.  doi: 10.1063/5.0219011.
- 2 **Z. Van Herstraeten**, N. J. Cerf, S. Guha, and C. N. Gagatsos, "Majorization theoretical approach to entanglement enhancement via local filtration," *Phys. Rev. A*, vol. 110, no. 4, p. 042430, Oct. 2024.  doi: 10.1103/PhysRevA.110.042430.
- 3 **Z. Van Herstraeten**, S. Guha, and N. J. Cerf, "Classical capacity of quantum non-Gaussian attenuator and amplifier channels," *Int. J. Quantum Inf.*, vol. 22, no. 05, Aug. 2024.  doi: 10.1142/s0219749924400033.
- 4 N. J. Cerf, A. Hertz, and **Z. Van Herstraeten**, "Complex-valued Wigner entropy of a quantum state," *Quantum Stud. Math. Found.*, Oct. 2023.  doi: 10.1007/s40509-024-00325-8.

- 5 **Z. Van Herstraeten**, M. G. Jabbour, and N. J. Cerf, "Continuous majorization in quantum phase space," *Quantum*, vol. 7, p. 1021, May 2023.  doi: 10.22331/q-2023-05-24-1021.
- 6 **Z. Van Herstraeten**, M. G. Jabbour, and N. J. Cerf, "Majorization ladder in bosonic Gaussian channels," *AVS Quantum Sci.*, vol. 5, no. 1, p. 011 401, Mar. 2023.  doi: 10.1116/5.0129704.
- 7 **Z. Van Herstraeten** and N. J. Cerf, "Quantum Wigner entropy," *Phys. Rev. A*, vol. 104, no. 4, p. 042 211, Oct. 2021.  doi: 10.1103/PhysRevA.104.042211.
- 8 U. Singh, M. G. Jabbour, **Z. Van Herstraeten**, and N. J. Cerf, "Quantum thermodynamics in a multipartite setting: A resource theory of local Gaussian work extraction for multimode bosonic systems," *Phys. Rev. A*, Oct. 2019.  doi: 10.1103/PhysRevA.100.042104.

Theses

- 1 **Z. Van Herstraeten**, "Majorization theoretical approach to quantum uncertainty – From Wigner entropy to Gaussian bosonic channels," Ph.D. dissertation, Université libre de Bruxelles, Brussels, 2021.
- 2 **Z. Van Herstraeten**, "Differential entropies in phase space for quantum photonic systems," M.S. thesis, Université libre de Bruxelles, Brussels, 2017.

Awards

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| 2021 |  BAEF Postdoctoral Fellowship
<i>Belgian American Educational Foundation (BAEF)</i>
One-year postdoctoral fellowship awarded to support Belgian scholars conducting research in the United States. |
| 2017 |  F.R.S. - FNRS Doctoral Fellowship (FRIA)
<i>Fonds de la Recherche Scientifique (FNRS), Belgium</i>
Competitive four-year doctoral fellowship supporting PhD training in the exact and natural sciences. |