

# Christophe Vuillot

## Curriculum Vitæ

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## Research interests

I am interested in quantum error correction and fault-tolerant implementations of universal quantum computation using both discrete and continuous variable quantum systems.

## Employment

2021– **Permanent researcher (Chargé de Recherche)**, *Inria*, Nancy.  
In team MOCQUA.

2019–2020 **Post-doc**, *Inria*, Paris.  
In team SECRET, as part of the QCDA European project.

## Education

2017–2019 **PhD (2nd half)**, *TU Delft, QuTech*, Delft.  
under the direction of Barbara Terhal. Thesis title:  
**Fault-Tolerant Quantum Computation: Theory and Practice**  
*Defense 15 January 2020.*

2015–2017 **PhD (1st half)**, *RWTH Aachen university, IQI*, Aachen.  
under the direction of Barbara Terhal.

2014–2015 **Master**, *Paris Diderot University*, Paris.  
Parisian Master of Research in Computer Science (MPRI).

2013–2014 **1st year Master**, *ENS Cachan*, Cachan.  
Physics, theory, experiment and modeling (PHYTEM).

2012–2013 **Year off**.  
Musical studies.

2011–2012 **1st year Master**, *ENS Rennes*, Rennes.  
Computer science.

**Licence**, *Université de Rennes 1*, Rennes.  
Physics.

2010–2011 **Licence**, *ENS Rennes*, Rennes.  
Computer science.

2008–2010 **MPSI/MP\***, *Lycée Henri IV*, Paris.  
Preparatory classes to the French national competitive exams for the Grandes Écoles.

2008 **French Baccalauréat**.  
Mention très bien.

## Publications

- [1] Anthony Leverrier, Simon Apers, and Christophe Vuillot. Quantum xyz product codes. *arXiv:2011.09746 [quant-ph]*, November 2020.

- [2] Barbara Terhal, Jonathan Conrad, and Christophe Vuillot. Towards scalable bosonic quantum error correction. *Quantum Science and Technology*, 2020.
- [3] Christophe Vuillot. *Fault-tolerant quantum computation: Theory and practice*. PhD thesis, TU Delft, 2020.
- [4] Christophe Vuillot and Nikolas P. Breuckmann. Quantum Pin Codes. *arXiv:1906.11394 [quant-ph]*, June 2019. Submitted to IEEE Transactions on Information Theory.
- [5] Christophe Vuillot, Lingling Lao, Ben Criger, Carmen García Almudéver, Koen Bertels, and Barbara M. Terhal. Code deformation and lattice surgery are gauge fixing. *New Journal of Physics*, 21(3):033028, March 2019.
- [6] Christophe Vuillot, Hamed Asasi, Yang Wang, Leonid P. Pryadko, and Barbara M. Terhal. Quantum error correction with the toric Gottesman-Kitaev-Preskill code. *Physical Review A*, 99(3):032344, March 2019.
- [7] Victor V. Albert, Kyungjoo Noh, Kasper Duivenvoorden, Dylan J. Young, R. T. Brierley, Philip Reinhold, Christophe Vuillot, Linshu Li, Chao Shen, S. M. Girvin, Barbara M. Terhal, and Liang Jiang. Performance and structure of single-mode bosonic codes. *Physical Review A*, 97(3):032346, March 2018.
- [8] Christophe Vuillot. Is error detection helpful on IBM 5q chips ? *Quantum Information and Computation*, 18(11&12):0949–0964, September 2018.
- [9] Nikolas P. Breuckmann, Christophe Vuillot, Earl Campbell, Anirudh Krishna, and Barbara M. Terhal. Hyperbolic and semi-hyperbolic surface codes for quantum storage. *Quantum Science and Technology*, 2(3):035007, 2017.
- [10] Earl T. Campbell, Barbara M. Terhal, and Christophe Vuillot. Roads towards fault-tolerant universal quantum computation. *Nature*, 549(7671):172–179, September 2017.
- [11] Erwan Faou, Fabio Nobile, and Christophe Vuillot. Sparse spectral approximations for computing polynomial functionals. *arXiv:1207.3728 [math]*, July 2012.

## Invited and contributed talks

- Jul. 2019 **QEC19**, *University College London*, London.  
Contributed talk : *Quantum Pin Codes*, with N.P. Breuckmann.  
Recorded: [https://youtu.be/55a8SYm2d\\_U](https://youtu.be/55a8SYm2d_U)
- Apr. 2019 **BQIT:19**, *University of Bristol*, Bristol.  
Invited talk : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.  
Recorded: <https://youtu.be/OI1xUYVok2M>
- Feb. 2019 **Qiskit camp**, *IBM Watson Research center*, Yorktown Heights.  
Invited talk : *Is error detection helpful on IBM 5Q chips?*  
Recorded: <https://youtu.be/Vr8K1owe4YQ>
- Nov. 2018 **GT IQ (GdR IM)**, *Loria*, Nancy.  
Invited talk : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.
- Nov. 2018 **QCDA kickoff meeting**, *Inria*, Paris.  
Two invited talk : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal and a *Tutorial on Continuous Variable Systems in Quantum Mechanics*
- Jul. 2018 **TQC 2018**, *University of Technology*, Sydney.  
Contributed talk : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.

## Seminars

- Dec. 2019 **Seminar**, *RWTH Aachen University*, Aachen.  
Invited seminar : *Quantum Pin Codes*, with N.P. Breuckmann.
- Feb. 2019 **Seminar**, *University College London*, London.  
Invited seminar : *Code Deformation and Lattice Surgery Are Gauge Fixing*, with L. Lao, B. Criger, C.G. Almudever, K. Bertels and B.M. Terhal.
- Jan. 2019 **Seminar**, *University of California*, Riverside.  
Invited seminar : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.
- Jan. 2019 **Seminar**, *Caltech*, Pasadena.  
Invited seminar: *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.

## Posters and schools

- Jan. 2019 **QIP 2019**, *University of Colorado*, Boulder.  
Accepted poster : *Code Deformation and Lattice Surgery Are Gauge Fixing*, with L. Lao, B. Criger, C.G. Almudever, K. Bertels and B.M. Terhal.
- Jan. 2019 **QIP 2019**, *University of Colorado*, Boulder.  
Accepted poster : *Quantum Error Correction with the Toric-GKP Code*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.
- Nov. 2018 **ICOQC 2018**, *ENS*, Paris.  
Accepted poster : *Decoding continuous variable stabilizer codes*, with H. Asasi, Y. Wang, L.P. Pryadko and B.M. Terhal.
- Dec. 2017 **THINKQ**, *IBM Watson Research center*, Yorktown Heights.  
Accepted poster : *Is error detection helpful on IBM 5Q chips?*
- Sept. 2017 **QEC 2017**, *University of Maryland*, College Park.  
Accepted poster : *Limitations of continuous variables encodings*, with L.P. Pryadko and B.M. Terhal.
- Jan. 2017 **QIP 2017**, *Microsoft Research*, Seattle.  
Accepted poster : *Versatile lattice code surgery*, with B.M. Terhal.
- Sept. 2016 **TQC 2016**, Berlin.  
Accepted poster : *Systematic construction of color codes in any dimension*, with N. Breuckmann.
- Aug. 2016 **Benasque workshop**, *CCBPP*, Benasque, Fault-tolerant Quantum Technologies.  
Talk on *Versatile lattice code surgery*, with B.M. Terhal.
- Sept. 2015 **IDEA league school**, *ETH Zurich*, Zurich.  
Quantum information and communication.
- Feb. 2015 **IDEA league school**, *RWTH Aachen university*, Aachen.  
Introduction to quantum information.

## Awards & Scholarships

- 2018 **IBM Q Best Paper Award**, *1st place*, for [8].  
For the highest-impact scientific papers by a master student, PhD student or postdoctoral researcher using the IBM Q Experience and Qiskit as tools to achieve the presented results. (\$1500)
- 2010–2015 **Normalien**, *ENS Rennes*, Rennes.  
Four-year scholarship from ENS Rennes, awarded through national competitive exams. (Full time salary)

## Research Internships

2015 **Construction of approximate ground state projections**, Mar.–Aug.  
supervisor Thomas Vidick  
Institution Caltech, IQIM

2014 **Competition between Hamiltonian and dissipative dynamics in topologically ordered fermionic systems**, Apr.–Aug.  
supervisor Christina Kraus and Mikhail Baranov  
Institution University of Innsbruck, IQOQI

2012 **On the existence of NPT bound-entangled states**, Jun.–Aug.  
supervisor Zhengfeng Ji and Debbie Leung  
Institution University of Waterloo, IQC

2011 **Sparse spectral approximations for computing polynomial functionals**, May.–Jul.  
supervisor Erwan Faou and Fabio Nobile  
Institution University of Rennes 1, IRMAR

## Teaching

- Spring–2018 **Quantum Information Theory**, *TU Delft*, Delft.  
Master level, tutorial sessions. Teacher: M. Caspers
- Winter 2016 **Electrodynamics**, *RWTH Aachen university*, Aachen.  
Bachelor level, helping students with their assignments. Teacher: B. Terhal
- Summer 2016 **Quantum Information Theory**, *RWTH Aachen university*, Aachen.  
Master level, conception of the exercises and tutorial sessions. Teacher: D. DiVincenzo
- Winter 2015 **Quantum error correction seminar**, *RWTH Aachen university*, Aachen.  
Two lectures.
- 2012–2013 **Introduction to programming with Maple**, *Lycée Henri IV*, Paris.  
MPSI students (equivalent to first year bachelor), Conception of the exercises and tutorial sessions.

## Reviewing activities

TQC conference, QIP conference, Rinton Press Quantum Information & Computation, IOP Quantum Science and Technology, Quantum, IEEE Transactions on Applied Superconductivity

## Organization

- 2017–2019 Organizing a Journal Club on quantum information at TU Delft, QuTech.  
Jan 2018 QIP 2018 conference assistant.  
2017 Organizing a Journal Club on quantum information at RWTH Aachen university, IQI.

## Languages

French Mother tongue  
English Fluent