14th Conference on the Theory of Quantum Computation, Communication and Cryptography

TQC 2019, June 3–5, 2019, Maryland, USA

Edited by

Wim van Dam

Laura Mančinska

Editors

Wim van Dam
University of California, Santa Barbara, CA, U.S.A.
QC Ware, Palo Alto, CA, U.S.A.
vandam@ucsb.edu

Laura Mančinska

University of Copenhagen, Denmark
mancinska@math.ku.dk

ACM Classification 2012
Theory of computation → Quantum computation theory; Theory of computation → Quantum complexity theory; Theory of computation → Quantum communication complexity; Theory of computation → Quantum query complexity; Theory of computation → Quantum information theory; Theory of computation → Quantum complexity theory; Hardware → Quantum communication and cryptography; Hardware → Quantum error correction and fault tolerance; Computer systems organization → Quantum computing

ISBN 978-3-95977-112-2

Published online and open access by
Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at https://www.dagstuhl.de/dagpub/978-3-95977-112-2.

Publication date
May, 2019

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at https://portal.dnb.de.

Digital Object Identifier: 10.4230/LIPIcs.TQC.2019.0

ISBN 978-3-95977-112-2 **ISSN 1868-8969** **https://www.dagstuhl.de/lipics**

LIPIcs – Leibniz International Proceedings in Informatics

LIPIcs is a series of high-quality conference proceedings across all fields in informatics. LIPIcs volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

ISSN 1868-8969

https://www.dagstuhl.de/lipics

Contents

Regular Papers

14th Conference on the Theory of Quantum Computation, Communication and Cryptography.
Editors: Wim van Dam and Laura Mančinska
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Charter, Previous Editions, Steering Committee

TQC Charter Statement

The Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC) is a conference for students and researchers working on theoretical aspects of quantum computation and quantum information. This includes, but is not limited to, quantum algorithms, models of quantum computation, quantum complexity theory, simulation of quantum systems, quantum cryptography, quantum communication, quantum information theory, quantum estimation and measurement, the intersection of quantum information and condensed-matter theory, quantum coding theory, fault-tolerant quantum computing, and entanglement theory. It is the goal of the conference to present recent major results on the theory of quantum computing and to support the building of a research community.

Previous Editions of TQC

- 2018, July 16–18, University of Technology Sydney, Australia
- 2017, June 14–16, Université Pierre et Marie Curie, Paris, France
- 2016, September 27–29, Berlin, Germany
- 2015, May 20–22, Université libre de Bruxelles, Brussels, Belgium
- 2014, May 21–23, Centre for Quantum Technologies, National University of Singapore
- 2013, May 21–23, University of Guelph, Canada
- 2012, May 17–19, University of Tokyo, Japan
- 2011, May 24–26, Madrid, Spain
- 2010, April 13–15, University of Leeds, UK
- 2009, May 11–13, Institute for Quantum Computing, University of Waterloo, Canada
- 2008, January 30–February 1, University of Tokyo, Tokyo, Japan
- 2007, January 24–25, Nara Institute of Science and Technology, Nara, Japan
- 2006, February 22–23, NTT R&D Center, Atsugi, Kanagawa, Japan

TQC Steering Committee

- Anne Broadbent
- Wim van Dam
- Aram Harrow (chair)
- Stacey Jeffery
- Yasuhito Kawano
- Martin Roetteler
- Simone Severini
- Marco Tomamichel

14th Conference on the Theory of Quantum Computation, Communication and Cryptography.
Editors: Wim van Dam and Laura Mančinska

Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Organization TQC 2019

Program Committee

- Juan Miguel Arrazola
- Salman Beigi
- Mario Berta
- Sergey Bravyi
- André Chailloux
- Eric Chitambar
- Elizabeth Crosson
- Wim van Dam (co-chair)
- Omar Fawzi
- Steven Flammia
- Keisuke Fujii
- Ernesto F. Galvão
- Rahul Jain
- Zhengfeng Ji
- Shelby Kimmel
- Robert König
- François Le Gall
- Laura Mančinska (chair)
- Serge Massar
- Tobias J. Osborne
- Maris Ozols
- Christopher Portmann
- Ana Belén Sainz
- Pranab Sen
- Barbara Terhal
- John Watrous
- Ronald de Wolf

Local Organizing Committee

- Gorjan Alagic (chair)
- Alexey Gorshkov
- Andrew Childs
- Yi-Kai Liu
- Carl Miller
- Aarthi Sundaram (chair)
- Jacob Taylor

14th Conference on the Theory of Quantum Computation, Communication and Cryptography.
Editors: Wim van Dam and Laura Mančinska
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Outstanding Paper Award

From the conference track submissions, the Program Committee selected as the TQC 2019 Outstanding Paper:

D. Gosset and J. Smolin, "A compressed classical description of quantum states"

14th Conference on the Theory of Quantum Computation, Communication and Cryptography.
Editors: Wim van Dam and Laura Mančinska
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Accepted Workshop Talks

- Gorjan Alagic, Tommaso Gagliardoni, and Christian Majenz, "Unforgeable authentication and signing of quantum states"
- Alessandro Bisio and Paolo Perinotti, "Axiomatic theory of higher-order quantum computation"
- Paul Boes, Jens Eisert, Rodrigo Gallego, Markus Mueller, and Henrik Wilming, "Von Neumann entropy from unitarity", merged with
  Paul Boes, Henrik Wilming, Rodrigo Gallego, and Jens Eisert, "Catalytic quantum randomness"
- Johannes Borregaard, Hannes Pichler, Tim Schröder, Mikhail D. Lukin, Peter Lodahl, and Anders S. Sørensen, "One-way quantum repeater with minimal-resources"
- Andrew M. Childs, Aaron Ostrander, and Yuan Su, "Faster quantum simulation by randomization", merged with
  Andrew M. Childs and Yuan Su, "Nearly optimal lattice simulation by product formulas"
- Matthias Christandl, Angelo Lucia, Péter Vrana, and Albert H. Werner, "Tensor network representations from the geometry of entangled states"
- Patricia Contreras-Tejada, Carlos Palazuelos, and Julio I. de Vicente, "A resource theory of entanglement with a unique multipartite maximally entangled state"
- Nilanjana Datta, Christoph Hirche, and Andreas Winter, "Convexity and operational interpretation of the quantum information bottleneck function"
- Philippe Faist, Sepehr Nezami, Victor V. Albert, Grant Salton, Fernando Pastawski, Patrick Hayden, and John Preskill, "Continuous symmetries and approximate quantum error correction", merged with
  Mischa P. Woods and Álvaro M. Alhambra, "Continuous groups of transversal gates for quantum error correcting codes from finite clock reference frames"
- Steven T. Flammia and Joel J. Wallman, "Efficient learning of Pauli channels"
- Carlos E. González-Guillén and Toby S. Cubitt, "History-state Hamiltonians are critical"
- Alex B. Grilo, " A simple protocol for verifiable delegation of quantum computation in one round"
- Arne L. Grimsmo, Joshua Combes, and Ben Q. Baragiola, "Quantum computing with rotation-symmetric bosonic codes"
- Tamara Kohler and Toby Cubitt, "Toy models of holographic duality between local Hamiltonians"
- François Le Gall, Harumichi Nishimura, and Ansis Rosmanis, "Quantum advantage for the LOCAL model in distributed computing"
- Guang Hao Low, Vadym Kliuchnikov, and Luke Schaeffer, "Trading T-gates for dirty qubits in state preparation and unitary synthesis"
- Iman Marvian and Seth Lloyd, "Universal quantum emulator"
- Thomas Vidick and Tina Zhang, "Classical zero-knowledge arguments for quantum computations"
- Guanyu Zhu, Ali Lavasani, and Maissam Barkeshli, "Universal logical gate sets with constant-depth circuits for topological and hyperbolic quantum codes"

14th Conference on the Theory of Quantum Computation, Communication and Cryptography.
Editors: Wim van Dam and Laura Mančinska

Leibniz International Proceedings in Informatics
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany