

Xin Wang

Staff Researcher

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RESEARCH INTERESTS

Quantum Information, Quantum Computation, Quantum Communication, Quantum Resource Theories, Optimization, Machine Learning, Quantum Programming.

RESEARCH POSITIONS

- 07/2019– **Staff Researcher**, Institute for Quantum Computing, Baidu Research, Beijing.
- 09/2018– **Hartree Postdoctoral Fellow**, Joint Center for Quantum Information and Computer Science (QICS), University of Maryland, College Park, MD.

EDUCATION

- 08/2014– **Ph.D. in Quantum Information**, *University of Technology Sydney*.
- 08/2018 Supervisors: Prof. Runyao Duan and Prof. Andreas Winter (external, UAB)
Thesis: Semidefinite Optimization for Quantum Information
(2018 Chancellor's List for Outstanding Thesis)
- 09/2010– **Bachelor of Science**, *Department of Mathematics, Sichuan University*, with a honor
06/2014 degree from the Wu Yuzhang Honors College.

AWARDS AND SCHOLARSHIPS

- 2019 Baidu Seasonal Star Award.
- 2018 QICS Hartree Fellowship, University of Maryland, College Park.
- 2018 Chancellor's List for Outstanding Thesis (top seven outstanding theses across UTS).
- 2018 Outstanding Self-financed Overseas Student Scholarship (500 recipients among all the self-financed overseas students from China; Awarded by China Scholarship Council).
- 2018 UTS Post Thesis Publication Award.
- 2017 FEIT Higher Degree by Research Publication Award.
- 2017 UTS Faculty of Engineering and Information Technology Scholarship.
- 2014 Australian Research Council Discovery Scholarship.
- 2014 UTS International Research Scholarship.
- 2010 Wu Yuzhang Honors (top 1.5% of ten thousand freshmen in Sichuan University).

REFEREED CONFERENCE TALKS

The Conference on Quantum Information Processing (QIP, 7 talks) is the premier and most competitive conference in theoretical aspects of quantum information science and features only the most important advances each year. AQIS (3 long+7 short talks) and TQC (1 talk) are both international leading conferences in the field of quantum information science, and ISIT is the main event in information theory (6 talks). In the following list, (*) indicates delivery by my co-author.

- 01/2020 **QIP 2020**, *Quantifying the magic resources for quantum computation*, Peng Cheng Laboratory and SUSTeCh, Shenzhen, China.
- 01/2020 **QIP 2020**, *Resource theory of asymmetric distinguishability*, Peng Cheng Laboratory and SUSTeCh, Shenzhen, China.
- 01/2019 **QIP 2019**, *Entanglement cost of quantum state preparation and channel simulation*, JILA, University of Colorado Boulder, USA.
- 02/2019* **SQuInT 2019**, *Exact entanglement cost of quantum states and channels under PPT-preserving operations*, CQulC, Albuquerque, New Mexico, USA.
- 03/2019 **APS March meeting**, *Entanglement cost of quantum state preparation and channel simulation*, APS March meeting, Boston, USA.
- 08/2019 **AQIS 2019 (long talk)**, *Efficiently computable bounds for magic state distillation*, Korea Institute for Advanced Study, Seoul, Korea.
- 08/2019 **AQIS 2019**, *Resource theory of asymmetric distinguishability*, Korea Institute for Advanced Study, Seoul, Korea.
- 01/2018 **QIP 2018**, *On converse bounds for classical communication over quantum channels*, QuTech, Delft, Netherlands.
- *01/2018 **QIP 2018**, *Efficiently computable upper bounds for quantum communication*, QuTech, Delft, Netherlands.
- *07/2018 **TQC 2018**, *Quantum Channel Simulation and the Channel's Smooth Max Information*, UTS, Sydney, Australia.
- *09/2018 **AQIS 2018**, *Distillation of quantum coherence in non-asymptotic settings*, Nagoya University, Nagoya, Japan.
- 06/2018 **ISIT 2018**, *On finite blocklength converse bounds for classical communication over quantum channels*, Vail, Colorado, USA.
- 06/2018 **ISIT 2018**, *Converse bounds for classical communication over quantum broadcast channels and quantum multi-access channels*, Vail, Colorado, USA.
- *06/2018 **ISIT 2018**, *Quantum Channel Simulation and the Channel's Smooth Max Information*, Vail, Colorado, USA.
- 01/2017 **QIP 2017**, *Asymptotic entanglement manipulation under PPT operations: new SDP bounds and irreversibility*, Microsoft Research, Redmond, USA.
- 01/2017 **QIP 2017**, *Semidefinite programming strong converse bounds for quantum channel capacities*, Microsoft Research, Redmond, USA.
- 09/2017 **AQIS 2017 (long talk, top 10% of all submissions)**, *Irreversibility of Asymptotic Entanglement Manipulation Under PPT-preserving Operations*, NUS, Singapore.
- *09/2017 **AQIS 2017 (long talk, top 10% of all submissions)**, *Non-asymptotic entanglement distillation*, National University of Singapore, Singapore.

- *09/2017 **AQIS 2017**, *Semidefinite programming converse bounds for quantum communication*, National University of Singapore, Singapore.
- *09/2017 **AQIS 2017**, *Approximate broadcasting of quantum correlations*, National University of Singapore, Singapore.
- 06/2017 **ISIT 2017**, *Semidefinite programming converse bounds for classical communication over quantum channels*, RWTH Aachen University, Aachen.
- 08/2016 **AQIS 2016**, *Separation between quantum Lovász number and entanglement-assisted zero-error classical capacity*, Academia Sinica, Taipei.
- *08/2016 **AQIS 2016**, *Improved Semidefinite Programming Upper Bound on Distillable Entanglement and Non-additivity of Rains' Bound*, Academia Sinica, Taipei.
- *08/2016 **AQIS 2016**, *Tripartite-to-bipartite entanglement transformation by SLOCC and the classification of matrix spaces*, Academia Sinica, Taipei.
- 07/2016 **ISIT 2016**, *A semidefinite programming upper bound of quantum capacity*, Barcelona.
- 07/2016 **ISIT 2016**, *On the quantum no-signalling assisted zero-error simulation cost of non-commutative bipartite graphs*, Barcelona.

INVITED TALKS

- 06/2020 **TBA**. TQC 2020, University of Latvia, Riga, Latvia.
- 07/2019 **Quantifying the magic resources for quantum computation**. Institute for Quantum Computing, University of Waterloo, Waterloo, Canada.
- 07/2019 **Quantifying the magic resources for quantum computation**. BIRS workshop on Algebraic and Statistical ways into Quantum Resource Theories, Banff, Canada.
- 06/2019 **Introduction to quantum computing (lectures and tutorials)**, Illinois Quantum Computing Summer School, Chicago, USA.
- 05/2019 **Quantifying the magic of quantum channels**. Department of Physics and Astronomy, Louisiana State University, USA.
- 12/2018 **Semidefinite optimization for quantum information**. Center for Computation and Technology, Louisiana State University, USA.
- 12/2018 **Quantification and manipulation of quantum coherence**. Department of Physics and Astronomy, Louisiana State University, USA.
- 06/2018 **Quantum state redistribution with and without communication**. Rocky Mountain Summit on Quantum Info, University of Colorado, Boulder, USA.
- 01/2018 **Asymptotic entanglement manipulation under PPT operations**. Maths Seminar, University of Nottingham, UK.
- 01/2018 **Semidefinite optimization for quantum information processing**. GAMP/QMATH Lecture, University of Copenhagen, Denmark.
- 11/2017 **Evaluating communication capabilities of quantum channels**. QCQIP 2017, AMSS, Chinese Academy of Sciences, Beijing, China.
- 07/2017 **Semidefinite programming strong converse bounds for channel capacities**. Beyond i.i.d. in Information Theory Workshop, NUS, Singapore.
- 06/2017 **Strong converse bounds for communication over quantum channels**. Quantum Information Seminar, SUSTech, Shenzhen, China.

12/2015 **Activated zero-error classical communication of quantum channels.** Sydney Quantum Information Theory Workshop, UTS, Sydney, Australia.

PROFESSIONAL SERVICE

- Program Committee 19th Asian Quantum Information Science Conference (AQIS 2019).
- Journal Referee Communications in Mathematical Physics, IEEE Transactions on Information Theory, and Journal of Physics A: Mathematical and Theoretical.
- Conference Referee Conference on Quantum Information Processing (QIP), IEEE International Symposium on Information Theory (ISIT), Asian Quantum Information Science Conference (AQIS), and IEEE Information Theory Workshop (ITW).
- Conference organization Coordinator of QIP 2015 (Sydney) and International Workshop on Quantum Computing and Quantum Information Processing 2017 (Beijing).

PUBLICATIONS

I have 21 papers published in refereed journals, 7 papers published in peer-reviewed conference proceedings and 7 preprint papers under review. I published 4 papers in Physical Review Letters (premier journal in physics), 6 papers in IEEE Transactions on Information Theory (premier journal in information theory), and 1 paper in Communications in Mathematical Physics (premier journal in mathematical physics). My publications are also available on arXiv and Google Scholar.

PEER-REVIEWED JOURNAL ARTICLES

- (J1) **X. Wang**, M. M. Wilde, and Y. Su, *Quantifying the magic of quantum channels*, New Journal of Physics 21, 103002, 2019, **(Contributed talk at QIP 2020)**.
- (J2) **X. Wang** and M. M. Wilde, *Resource theory of asymmetric distinguishability*, Physical Review Research 1, 033170, **(Contributed talk at QIP 2020)**.
- (J3) **X. Wang**, M. M. Wilde, and Y. Su, *Efficiently computable bounds for magic state distillation*, Physical Review Letters (in press, 2020).
- (J4) **X. Wang**, K. Fang, and M. Tomamichel, *On converse bounds for classical communication over quantum channels*, IEEE Transactions on Information Theory 65(7): 4609-4619, 2019, **(Contributed talk at QIP 2018)**.
- (J5) **X. Wang**, K. Fang, and R. Duan, *Semidefinite programming converse bounds for quantum communication*, IEEE Transactions on Information Theory 65(4): 2583-2592, 2019, **(Contributed talk QIP 2018)**.
- (J6) **X. Wang** and M. M. Wilde, *Resource theory of asymmetric distinguishability for quantum channels*, Physical Review Research 1, 033169, 2019.
- (J7) K. Fang, **X. Wang**, M. Tomamichel, and R. Duan, *Non-asymptotic entanglement distillation*, IEEE Transactions on Information Theory 65(10): 6454-6465, 2019.
- (J8) K. Fang, **X. Wang**, M. Tomamichel, and M. Berta, *Quantum Channel Simulation and the Channel's Smooth Max-Information*, in IEEE Transactions on Information Theory (in press), 2019.
- (J9) B. Regula, K. Fang, **X. Wang**, and M. Gu, *One-shot entanglement distillation beyond LOCC*, New Journal of Physics 21, 103017, 2019.

- (J10) **X. Wang**, W. Xie, and R. Duan, *Semidefinite programming strong converse bounds for classical capacity*, IEEE Transactions on Information Theory 64(1): 640-653, 2018, **(Contributed talk QIP 2017)**.
- (J11) K. Fang, **X. Wang**, L. Lami, B. Regula, and G. Adesso, *Probabilistic distillation of quantum coherence*, Physical Review Letters 121, 070404, 2018.
- (J12) **X. Wang** and R. Duan, *Separation between quantum Lovász number and entanglement-assisted zero-error classical capacity*, IEEE Transactions on Information Theory 64(3): 1454-1460, 2018.
- (J13) B. Regula, K. Fang, **X. Wang**, and G. Adesso, *One-shot coherence distillation*, Physical Review Letters 121, 010401, 2018.
- (J14) Y. Li, Y. Qiao, **X. Wang**, and R. Duan, *Tripartite-to-bipartite Entanglement Transformation by Stochastic Local Operations and Classical Communication and the Classification of Matrix Spaces*, Communications in Mathematical Physics 358(2): 791-814, 2018.
- (J15) L. Lami, B. Regula, **X. Wang**, R. Nichols, A. Winter, and G. Adesso, *Gaussian quantum resource theories*, Physical Review A 98, 022335 (**Editors' Suggestion**), 2018.
- (J16) M. G. Díaz, K. Fang, **X. Wang**, M. Rosati, M. Skotiniotis, J. Calsamiglia, A. Winter, *Using and reusing coherence to realize quantum processes*, Quantum 2, 100, 2018.
- (J17) **X. Wang** and R. Duan, *Irreversibility of Asymptotic Entanglement Manipulation Under Quantum Operations Completely Preserving Positivity of Partial Transpose*, Physical Review Letters 119, 180506, 2017 (**Contributed talk QIP 2017**).
- (J18) **X. Wang** and R. Duan, *Nonadditivity of Rains bound for distillable entanglement*, Physical Review A 95, 062322, 2017.
- (J19) Y. Li, **X. Wang**, R. Duan, *Indistinguishability of bipartite states by positive-partial-transpose operations in the many-copy scenario*, Physical Review A 95, 052346, 2017.
- (J20) W. Xie, K. Fang, **X. Wang**, and R. Duan, *Approximate broadcasting of quantum correlations*, Physical Review A 96, 022302, 2017.
- (J21) **X. Wang** and R. Duan, *Improved semidefinite programming upper bound on distillable entanglement*, Physical Review A 94, 050301 (Rapid Communication), 2016.

PEER-REVIEWED CONFERENCE PROCEEDINGS

- (C1) **X. Wang**, Kun Fang, and Marco Tomamichel, *On finite blocklength converse bounds for classical communication over quantum channels*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2018).
- (C2) S. Liu, **X. Wang**, L. Zhou, J. Guan, Y. Li, Y. He, R. Duan, and M. Ying, *$Q|SI$: A Quantum Programming Environment*, in Symposium on Real-Time and Hybrid Systems. Lecture Notes in Computer Science, vol 11180 (2018).
- (C3) K. Fang, **X. Wang**, M. Tomamichel, and M. Berta, *Quantum Channel Simulation and the Channel's Smooth Max-Information*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2018).
- (C4) W. Xie, **X. Wang**, and R. Duan, *Converse bounds for classical communication over quantum broadcast channels and quantum multi-access channels*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2018).
- (C5) **X. Wang**, W. Xie, and R. Duan, *Semidefinite programming converse bounds for classical communication over quantum channels*, Proceedings of the IEEE International Symposium on Information Theory (ISIT 2017).

- (C6) **X. Wang** and R. Duan, *A semidefinite programming upper bound of quantum capacity*, Proceedings of IEEE International Symposium on Information Theory (ISIT 2016).
- (C7) **X. Wang** and Runyao Duan, *On the quantum no-signalling assisted zero-error simulation cost of non-commutative bipartite graphs*, Proceedings of the IEEE International Symposium on Information Theory (ISIT 2016).

PREPRINTS

- (P1) Y. Hamoudi, M. Ray, P. Reberstrost, M. Santha, **X. Wang**, and S. Yang, *Quantum algorithms for hedging and the sparsitron*, arXiv:2002.06003.
- (P2) **X. Wang**, *Optimizing the fundamental limits for quantum and private communication*, arXiv:1912.00931, submitted.
- (P3) **X. Wang** and M. M. Wilde, *Exact entanglement cost of quantum states and channels under PPT operations*, arXiv:1809.09592, **(Contributed talk at QIP 2019)**.
- (P4) **X. Wang** and M. M. Wilde, *α -Logarithmic negativity*, arXiv:1904.10437, submitted.
- (P5) D. W. Berry, A. M. Childs, Y. Su, **X. Wang**, and N. Wiebe, *Time-dependent Hamiltonian simulation with L^1 -norm scaling*, arXiv:1906.07115, submitted.
- (P6) K. Wang, **X. Wang**, and M. M. Wilde, *Quantifying the unextendibility of entanglement*, arXiv:1911.07433, submitted.
- (P7) R. Duan and **X. Wang**, *Activated zero-error classical capacity of quantum channels in the presence of quantum no-signalling correlations*, available at arXiv:1510.05437.

REFERENCES

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(more references available upon request)