Xin Wang

Staff Researcher

Institute for Quantum Computing,
Baidu Research
Beijing 100193, China
✉ *wangxinfelix@gmail.com*
🖥 *www.xinwang.info*

RESEARCH INTERESTS

Quantum Information, Quantum Computation, Quantum Resource Theories, Quantum Machine Learning, Optimization, Quantum Optimal Control, Quantum Programming.

RESEARCH POSITIONS

07/2019– **Staff Researcher and Tech Leader**, Institute for Quantum Computing, Baidu, Beijing.

09/2018– **Hartree Fellow**, Joint Center for Quantum Information and Computer Science (QuICS),
07/2019 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

2020 Technology Innovation Award (Project Leader of Paddle Quantum: a quantum machine learning toolkit), Baidu Inc.

2020 Technology Pioneer Award, Baidu Inc.

2019 Seasonal Star Award, Baidu Inc.

2018 QuICS 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, UTS.

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+12 short talks) and TQC (4 talks + 1 **invited talk**) are both international leading conferences in the field of quantum information science, and ISIT is the main event in information theory (8 talks). In the following list, (*) indicates delivery by my co-author.

08/2021* **AQIS 2021**, *LOCCNet: a machine learning framework for distributed quantum information processing*, University of Tokyo, Japan.

08/2021* **AQIS 2021**, *Noise-Assisted Quantum Autoencoder*, University of Tokyo, Japan.

08/2021* **AQIS 2021**, *Variational Quantum Algorithms for Trace Distance and Fidelity Estimation*, University of Tokyo, Japan.

08/2021* **AQIS 2021**, *A Hybrid Quantum-Classical Hamiltonian Learning Algorithm*, University of Tokyo, Japan.

08/2021* **AQIS 2021**, *Symmetric distinguishability as a quantum resource*, University of Tokyo, Japan.

06/2021* **TQC 2021**, *Bounding the classical capacity of a quantum channel assisted by classical feedback*, University of Latvia, Riga, Latvia.

06/2021* **TQC 2021**, *Measurement Error Mitigation via Truncated Neumann Series*, University of Latvia, Riga, Latvia.

06/2021* **ISIT 2021**, *Upper bound on the classical capacity of a quantum channel assisted by classical feedback*, Melbourne, Australia.

06/2020 **TQC 2020**, *Optimizing the fundamental limits for quantum and private communication*, University of Latvia, Riga, Latvia.

06/2020* **ISIT 2020**, *Quantification of Unextendible Entanglement and Its Applications in Entanglement Distillation*, Los Angeles, USA.

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*, CQuIC, 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

12/2020   **Near-term Quantum Algorithms for Quantum Information**. Workshop on Quantum Computing and Quantum Information, Institute of Physics, CAS, Beijing, China.

12/2020   **Cost of quantum entanglement simplified**. AMSS-UTS Joint Workshop on Quantum Computing, AMSS, CAS and UTS.

07/2020   **Variational quantum algorithms for state preparation and matrix decomposition**. Center for Quantum Computing, Peng Cheng Laboratory, Shenzhen, China.

06/2020   **Quantum resource theories of quantum channels**. TQC 2020 (virtual), 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

Editor	Quantum.
Program Committee	21st Asian Quantum Information Science Conference (AQIS 2021), 19th Asian Quantum Information Science Conference (AQIS 2019), Beyond IID in Information Theory 8 (2020).
Journal Referee	Nature Communications, Physical Review Letters, npj Quantum Information, Quantum, PRX Quantum, Communications in Mathematical Physics, IEEE Transactions on Information Theory, Journal on Selected Areas in Information Theory, Quantum Science and Technology, Physical Review Research, 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), Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC), 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 36 papers published in refereed journals, 10 papers published in peer-reviewed conference proceedings and 10 preprint papers under review. In particular, I published 5 papers in Physical Review Letters (premier journal in physics), 8 papers in IEEE Transactions on Information Theory (premier journal in information theory), 2 papers in npj Quantum Information (premier journal in quantum information), and 1 paper in AAAI (top-tier conference in artificial intelligence). My publications are also available on arXiv and Google Scholar.

PEER-REVIEWED JOURNAL ARTICLES

(J36) K. Wang, Z. Song, X. Zhao, Z. Wang, and **X. Wang***, *Detecting and quantifying entanglement on near-term quantum devices*, npj Quantum Information (accepted), 2022.

(J35) D. Ding, S. Khatri, Y. Quek, P. W. Shor, **X. Wang**, and M. M. Wilde, *Bounding the forward classical capacity of bipartite quantum channels*, in IEEE Transactions on Information Theory (accepted), 2022.

(J34) J. Jiang, K. Wang, and **X. Wang***, *Physical Implementability of Linear Maps and Its Application in Error Mitigation*, Quantum 5, 600, 2021.

(J33) X. Zhao, B. Zhao, Z. Wang, Z. Song, and **X. Wang***, *LOCCNet: a machine learning framework for distributed quantum information processing*, npj Quantum Information 7, 159, 2021.

(J32) R. Chen, Z. Song, X. Zhao, and **X. Wang***, *Variational Quantum Algorithms for Trace Distance and Fidelity Estimation*, Quantum Science and Technology 7, 015019, 2021.

(J31) Y. Wang, G. Li, and **X. Wang***, *Variational quantum Gibbs state preparation with a truncated Taylor series*, Physical Review Applied 16, 054035, 2021.

(J30) Y. Wang, G. Li, and **X. Wang**, *A Hybrid Quantum-Classical Hamiltonian Learning Algorithm*, Science China Information Sciences (in press), 2021

(J29) **X. Wang**, Z. Song, and Y. Wang, *Variational Quantum Singular Value Decomposition*, Quantum 5, 483, 2021.

(J28) R. Salzmann, N. Datta, G. Gour, **X. Wang**, and M. M. Wilde, *Symmetric distinguishability as a quantum resource*, New Journal of Physics 23 083016, 2021.

(J27) **X. Wang**, *Pursuing the fundamental limits for quantum communication*, IEEE Transactions on Information Theory 67(7), 4524-4532, 2021.

(J26) C. Cao and **X. Wang***, *Noise-assisted Quantum Autoencoder*, Physical Review Applied 15, 054012, 2021.

(J25) **X. Wang** and M. M. Wilde, *Cost of quantum entanglement simplified*, Physical Review Letters 125, 040502, 2020, **(Contributed talk at QIP 2019)**.

(J24) **X. Wang**, M. M. Wilde, and Y. Su, *Efficiently computable bounds for magic state distillation*, Physical Review Letters 124, 090505, 2020.

(J23) **X. Wang**, M. M. Wilde, and Y. Su, *Quantifying the magic of quantum channels*, New Journal of Physics 21, 103002, **(Contributed talk at QIP 2020)**.

(J22) **X. Wang** and M. M. Wilde, α-*Logarithmic negativity*, Physical Review A (in press, 2020).

(J21) P. Rebentrost, Y. Hamoudi, M. Ray, **X. Wang**, S. Yang, and M. Santha, *Quantum algorithms for hedging and the sparsitron*, Physical Review A (in press, 2020).

(J20) **X. Wang** and M. M. Wilde, *Resource theory of asymmetric distinguishability*, Physical Review Research 1, 033170, **(Contributed talk at QIP 2020)**.

(J19) D. W. Berry, A. M. Childs, Y. Su, **X. Wang**, and N. Wiebe, *Time-dependent Hamiltonian simulation with L^1-norm scaling*, Quantum 4, 254, 2020.

(J18) 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 66(4): 2129-2140, 2020.

(J17) **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)**.

(J16) **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)**.

(J15) **X. Wang** and M. M. Wilde, *Resource theory of asymmetric distinguishability for quantum channels*, Physical Review Research 1, 033169, 2019.

(J14) K. Fang, **X. Wang**, M. Tomamichel, and R. Duan, *Non-asymptotic entanglement distillation*, IEEE Transactions on Information Theory 65(10): 6454-6465, 2019.

(J13) B. Regula, K. Fang, **X. Wang**, and M. Gu, *One-shot entanglement distillation beyond LOCC*, New Journal of Physics 21, 103017, 2019.

(J12) **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.

(J10) **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.

(J9) B. Regula, K. Fang, **X. Wang**, and G. Adesso, *One-shot coherence distillation*, Physical Review Letters 121, 010401, 2018.

(J8) 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.

(J7) 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.

(J6) 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.

(J5) **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).**

(J4) **X. Wang** and R. Duan, *Nonadditivity of Rains bound for distillable entanglement*, Physical Review A 95, 062322, 2017.

(J3) 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.

(J2) W. Xie, K. Fang, **X. Wang**, and R. Duan, *Approximate broadcasting of quantum correlations*, Physical Review A 96, 022302, 2017.

(J1) **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

(C10) G. Li, Z. Song, and **X. Wang***, *VSQL: Variational Shadow Quantum Learning for Classification*, in Proceedings of the Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI 2021).

(C9) D. Ding, S. Khatri, Y. Quek, P. W. Shor, **X. Wang**, and M. M. Wilde, *Upper bound on the classical capacity of a quantum channel assisted by classical feedback*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2021).

(C8) K. Wang, **X. Wang**, and M. Wilde, *Quantification of Unextendible Entanglement and Its Applications in Entanglement Distillation*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2020).

(C7) **X. Wang**, K. Fang, and M. Tomamichel, *On finite blocklength converse bounds for classical communication over quantum channels*, in Proceedings of the IEEE International Symposium on Information Theory (ISIT 2018).

(C6) S. Liu, **X. Wang**, L. Zhou, J. Guan, Y. Li, Y. He, R. Duan, and M. Ying, $Q|SI\rangle$: *A Quantum Programming Environment*, in Symposium on Real-Time and Hybrid Systems. Lecture Notes in Computer Science, vol 11180 (2018).

(C5) 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).

(C3) **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).

(C2) **X. Wang** and R. Duan, *A semidefinite programming upper bound of quantum capacity*, Proceedings of IEEE International Symposium on Information Theory (ISIT 2016).

(C1) **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

(P10) K. Wang, Y. A. Chen, and **X. Wang**, *Mitigating Quantum Errors via Truncated Neumann Series*, arXiv:2111.00691.

(P9) R. Chen, B. Zhao, and **X. Wang**, *Variational Quantum Algorithm for Schmidt Decomposition*, arXiv:2109.10785.

(P8) K. Wang, Y. A. Chen, and **X. Wang**, *Measurement Error Mitigation via Truncated Neumann Series*, arXiv:2103.13856.

(P7) J. Jiang and **X. Wang**, *Lower bound the T-count via unitary stabilizer nullity*, arXiv:2103.09999.

(P6) Y. Chen and **X. Wang**, *More Practical and Adaptive Algorithms for Online Quantum State Learning*, arXiv:2006.01013, submitted.

(P5) **X. Wang** and M. M. Wilde, *Exact entanglement cost of quantum states and channels under PPT operations*, arXiv:1809.09592.

(P4) K. Wang, **X. Wang**, and M. M. Wilde, *Quantifying the unextendibility of entanglement*, arXiv:1911.07433.

(P3) S. Baeuml, S. Das, **X. Wang**, and M. M. Wilde, *Resource theory of entanglement for bipartite quantum channels*, available at arXiv:1907.04181.

(P2) S. H. Hung, Y. Peng, **X. Wang**, S. Zhu, and X. Wu, *On the Theory and Practice of Invariant-based Verification of Quantum Programs*, submitted.

(P1) 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

Prof. Runyao Duan
Founding Director of Institute for Quantum Computing,
Baidu Research, Beijing, 100093, China
ARC Future Fellow and Professor
Director of Center for Quantum Software and Information
University of Technology Sydney, NSW 2007, Australia
✉ duanrunyao@baidu.com or runyao.duan@uts.edu.au

Prof. Andreas Winter
ICREA Research Professor
ICREA & Universitat Autònoma de Barcelona, ES-08193 Barcelona, Spain
✉ andreas.winter@uab.cat

Prof. Debbie Leung
Professor and University Research Chair
Institute for Quantum Computing
University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
✉ wcleung@uwaterloo.ca

(more references available upon request)