SUMEET KHATRI

CURRICULUM VITAE

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HIGHLIGHTS

Research
- Areas of interest: Quantum information theory, quantum communication and networking, quantum computing (algorithms, complexity theory, machine learning), quantum metrology and sensing, and quantum many-body physics.
- 13 peer-reviewed publications and 5 pre-prints. [Google Scholar page] [Papers on arXiv]

Teaching & mentorship
- Co-author of the book *"Principles of Quantum Communication Theory: A Modern Approach"* [B1].
- Designed and delivered a mini course on quantum communication theory in Natal, Brazil. (course information) (videos)
- Student mentorship and (co-)supervision: four undergraduate students, see [PR7], [PR10]; one Master's student, see [PP2]. Ongoing supervision of three Master's students.
- Completed a teacher training course at the University of Waterloo, 2015–2016.

Other items
- Creator of the Python package QuTIpy.
- Participant in the 2018 quantum computing summer school at LANL; see [PR5], [PR8].
- Recipient of the NSERC Postgraduate Scholarship.

EMPLOYMENT

Postdoctoral Researcher, Freie Universität Berlin Physics Department, Berlin, Germany   2021–PRESENT
Dahlem Center for Complex Quantum Systems. Supervisor: Jens Eisert

Quantum Computing Summer School Fellow, Los Alamos National Laboratory, Los Alamos, NM, USA   SUMMER 2018
Theoretical Division. Supervisor: Patrick Coles. (Summer internship)

EDUCATION

Louisiana State University, Baton Rouge, LA, USA   2017–2021
PhD Physics
- Thesis title: *Towards a General Framework for Practical Quantum Network Protocols*

University of Waterloo, Waterloo, ON, Canada   2014–2016
MSc Physics (Quantum Information)
- Thesis title: *Symmetric Extendability of Quantum States and the Extreme Limits of Quantum Key Distribution*

University of Waterloo, Waterloo, ON, Canada   2009–2014
BSc Honours Mathematical Physics (Co-operative), Astrophysics Specialization, Pure Mathematics Minor

Publications & Conference Presentations

Peer-Reviewed Articles

[PR13] Dawei Ding, **Sumeet Khatri**, Yihui Quek, Peter W. Shor, Xin Wang, Mark M. Wilde. *"Bounding the Forward Classical Capacity of Bipartite Quantum Channels"*. IEEE Transactions on Information Theory **69**(5), 3034 (2023), arXiv:2010.01058.

   ⋆ Contributed talk, TQC 2021.

   ⋆ Conference proceedings, 2021 IEEE International Symposium on Information Theory (ISIT).

[PR12] **Sumeet Khatri**. *"On the design and analysis of near-term quantum network protocols using Markov decision processes"*. AVS Quantum Science **4**, 030501 (2022).

   • Invited talk, Queuing Theory for Emerging Classical and Quantum Systems (Workshop at IFPF Performance 2023), November 2023. (Jointly with [PR11], [PP4].)

   • Invited talk, Quantum Networks Workshop, July 2023. (Jointly with [PR11], [PP4].)

   • Contributed talk, TQC 2022. (Jointly with [PR11].)

   • Poster, 5th Seefeld Workshop on Quantum Information, June 2022. (Jointly with [PR11].)

[PR11] **Sumeet Khatri**. *"Policies for elementary links in a quantum network"*. Quantum **5**, 537 (2021).

   • Invited talk, Queuing Theory for Emerging Classical and Quantum Systems (Workshop at IFPF Performance 2023), November 2023. (Jointly with [PR12], [PP4].)

   • Invited talk, Quantum Networks Workshop, July 2023. (Jointly with [PR12], [PP4].)

   • Poster, 5th Seefeld Workshop on Quantum Information, June 2022. (Jointly with [PR12].)

   • Contributed talk, TQC 2022. (Jointly with [PR12].)

   • Poster, AQIS 2021.

[PR10] **Sumeet Khatri**, Anthony J. Brady, Renée A. Desporte, Manon P. Bart, Jonathan P. Dowling. *"Spooky action at a global distance: analysis of space-based entanglement distribution for the quantum internet"*. npj Quantum Information **7**, 4 (2021).

   ⋆ Poster, Frontiers in Optics 2019.

   ⋆ Contributed talk, APS March Meeting 2021.

   • Contributed talk, AQIS 2021.

[PR9] **Sumeet Khatri**, Kunal Sharma, Mark M. Wilde. *"Information-theoretic aspects of the generalized amplitude damping channel"*. Physical Review A **102**, 012401 (2020).

   • Contributed talk, APS March Meeting 2019.

[PR8] Kunal Sharma, **Sumeet Khatri**, M. Cerezo, Patrick J. Coles. *"Noise Resilience of Variational Quantum Compiling"*. New Journal of Physics **22**, 043006 (2020).

[PR7] **Sumeet Khatri**, Corey T. Matyas, Aliza U. Siddiqui, Jonathan P. Dowling. *"Practical figures of merit and thresholds for entanglement distribution in quantum networks"*. Physical Review Research **1**, 023032 (2019).

   • Contributed talk, SQuInT 2020.

   ⋆ Contributed talk, Frontiers in Optics 2019.

   • Invited talk, The Nature of Quantum Networks 2019 (Vienna).

   • Invited talk, 1st International Workshop on Quantum Network Science, 2019.

[PR6] Ludovico Lami, **Sumeet Khatri**, Gerardo Adesso, Mark M. Wilde. *"Extendibility of bosonic Gaussian states"*. Physical Review Letters **123**, 050501 (2019).

- ⋆ Contributed talk, TQC 2020.
- • Poster, Algebraic and Statistical ways into Quantum Resource Theories, 2019.

[PR5] **Sumeet Khatri**, Ryan LaRose, Alexander Poremba, Lukasz Cincio, Andrew T. Sornborger, Patrick J. Coles. *"Quantum-assisted quantum compiling"*. Quantum **3**, 140 (2019).

- • Poster, SQuInT 2019.
- • Poster, QIP 2019.

[PR4] Siddhartha Das, **Sumeet Khatri**, Jonathan P. Dowling. *"Robust quantum network architectures and topologies for entanglement distribution"*. Physical Review A **97**, 012335 (2018).

- • Contributed talk, Southeast Quantum Computing Workshop, 2018.
- ⋆ Contributed talk, SQuInT 2018.
- • Poster, QCMC 2018.
- • Poster, WQRN 2017.

[PR3] Siddhartha Das, **Sumeet Khatri**, George Siopsis, Mark M. Wilde. *"Fundamental limits on quantum dynamics based on entropy change"*. Journal of Mathematical Physics **59**, 012205 (2018).

- • Poster, QCMC 2018.
- • Contributed talk, CQIQC-VII, 2017.

[PR2] **Sumeet Khatri**, Norbert Lütkenhaus. *"Numerical evidence for bound secrecy from two-way postprocessing in quantum key distribution"*. Physical Review A **95**, 042320 (2017).

- • Poster, QCrypt 2017.
- • Poster, QCMC 2016.

[PR1] Paul J. L. Charlton, Michael J. Husdon, Michael L. Balogh, **Sumeet Khatri**. *"The dependence of halo mass on galaxy size at fixed stellar mass using weak lensing"*. Monthly Notices of the Royal Astronomical Society **472**(2), 2367-2387 (2017).

Pre-Print Articles

[PP5] Johannes J. Meyer, **Sumeet Khatri**, Daniel S. França, Jens Eisert, Philippe Faist. *"Quantum metrology in the finite-sample regime"*. arXiv:2307.06370, July 2023.

- ⋆ Contributed talk, QIP 2024.
- ⋆ Contributed talk, Beyond IID 2023.
- • Contributed talk, APS March Meeting 2023.
- ⋆ Poster, 5th Seefeld Workshop on Quantum Information, June 2022.

[PP4] Stav Haldar, Pratik Barge, **Sumeet Khatri**, Hwang Lee. *"Fast and reliable entanglement distribution with quantum repeaters: principles for improving protocols using reinforcement learning"*. arXiv:2303.00777, March 2023.

- • Invited talk, Queuing Theory for Emerging Classical and Quantum Systems (Workshop at IFPF Performance 2023), November 2023. (Jointly with [PR11], [PR12].)
- • Invited talk, Quantum Networks Workshop, July 2023. (Jointly with [PR11], [PR12].)

[PP3] Yihui Quek, Daniel S. França, **Sumeet Khatri**, Johannes J. Meyer, Jens Eisert. *"Exponentially tighter bounds on limitations of quantum error mitigation"*. arXiv:2210.11505, October 2022.

- ⋆ Contributed talk, QIP 2023.
- • Contributed talk, APS March Meeting 2023.

[PP2] Simon Cichy, Paul K. Fährmann, **Sumeet Khatri**, Jens Eisert. *"Non-recursive perturbative gadgets without subspace restrictions and applications to variational quantum algorithms"*. arXiv:2210.03099, October 2022.

- ⋆ Poster, QIP 2023.
- ⋆ Poster, QTML 2022.

[PP1] **Sumeet Khatri**, Eneet Kaur, Saikat Guha, Mark M. Wilde. *"Second-order coding rates for key distillation in quantum key distribution"*. arXiv:1910.03883, October 2019.

Books

[B1] **Sumeet Khatri**, Mark M. Wilde. *"Principles of Quantum Communication Theory: A Modern Approach"*. arXiv:2010.01058, November 2020. See also here for a more up-to-date version.

Invited Conference Presentations & Seminars

17. Conference, APS March Meeting 2024 (Minneapolis, USA), 5 March 2024.
    "Algorithms for quantum computing, communication networks, and metrology: a near-term perspective".
    (Based on [PR11], [PR12], [PP4], [PP3], [PP5].)

16. Seminar, Scuola Normale Superiore, Pisa (group of Vittorio Giovanetti), 28 November 2023.
    "Protocols for quantum communication networks, computing, and metrology: a near-term perspective".
    (Based on [PR11], [PR12], [PP4], [PP3], [PP5].)

15. Conference, Queuing Theory for Emerging Classical and Quantum Systems (Workshop at IFPF Performance 2023) (Chicago, USA), 17 November 2023.
    "Optimal policies for quantum communication networks via Markov decision processes".
    (Based on [PR11], [PR12], [PP4].)

14. Conference, Quantum Networks Workshop (Boston, USA), July 2023.
    "Optimal policies for quantum communication networks: theoretical tools with practical guidance".
    (Based on [PR11], [PR12], [PP4].)

13. Seminar, Virginia Tech, Department of Computer Science, 13 February 2023.
    "Quantum Information Theory for Quantum Technologies: Fundamentals with Practical Guidance".

12. Seminar, UMass Amherst (group of Don Towsley), 23 August 2022.
    "On the design and analysis of near-term quantum network protocols using Markov decision processes".
    (Based on [PR11], [PR12].)

11. Seminar, Xanadu (invited by Juan Miguel Arrazola), 27 July 2022.
    "Policies for elementary links in a quantum network".
    (Based on [PR11], [PR12].)

10. Seminar, KACST (group of Mohammad Al-Amri), 23 March 2022.
    "Quantum communication from an information-theoretic perspective – overview and general principles".

9. Seminar, INQNET, 13 December 2021.
    "Optimal policies for near-term quantum networks".
    (Based on [PR11].)

8. Seminar (TU Berlin, group of Anna Pappa), 28 September 2021.
   "Policies for elementary links in a quantum network".
   (Based on [PR11].)

7. Seminar, Center for Quantum Networks, 24 June 2021.
   "Spooky action at a global distance: analysis of space-based entanglement distribution for the quantum internet".
   (Based on [PR10].)

6. Seminar, FU Berlin (group of Jens Eisert), 26 January 2021.
   "Variational quantum compiling and its noise resilience".
   (Based on [PR5], [PR8].)

5. Seminar, TU Delft (group of David Elkouss), 7 October 2020.
   "Policies for elementary link generation in quantum networks".
   (Based on [PR11].)

4. Seminar, Keio University (group of Rodney van Meter), 31 August 2020.
   "Policies for elementary link generation in quantum networks".
   (Based on [PR11].)

3. Conference, The Nature of Quantum Networks 2019 (Vienna, Austria), September 2019.
   "Practical figures of merit and thresholds for entanglement distribution in quantum networks".
   (Based on [PR7].)

2. Conference, 1st International Workshop on Quantum Network Science (Arizona, USA), May 2019.
   "Practical figures of merit and thresholds for entanglement distribution in quantum networks".
   (Based on [PR7].)

1. Seminar, IQC, 19 December 2018.
   "Quantum-assisted quantum compiling".
   (Based on [PR5].)

TEACHING

Invited Lecturer   SEPTEMBER 2022
International Centre for Mechanical Sciences (CISM), Udine, Italy

- Delivered a two-part lecture on hybrid quantum-classical algorithms at the European Summer School on Quantum AI summer school.

Mentor   2021–2022
QWorld

- Mentor in the quantum information theory study group in the QWorld organization; see here for details.

- Delivered lessons on quantum information theory, based on the exercises in [B1].

Visiting Lecturer   NOVEMBER 2019
International Institute of Physics, Natal, Brazil

- Delivered a five-lecture mini-course on quantum communication theory.

- Video recordings of the lectures here.

- Trip funded by the Brazil-US Student & Postdoc Visitation Program.

Graduate Teaching Assistant
2017–2018

Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA, USA

- Supervised two sections of the second-year physics laboratory course.

- Graded homework assignments for statistical mechanics (graduate) and electromagnetism (senior undergraduate) courses.

Fundamentals of University Teaching Certificate
2015–2016

Teaching training program for graduate students at the Centre for Teaching Excellence, University of Waterloo, Waterloo, ON, Canada

- Six workshops and three 15-minute teaching sessions.

- Selected workshops: Effective lesson plans, creating memorable lectures, teaching with confidence.

Laboratory Teaching Assistant
2014–2015

Department of Physics and Astronomy, University of Waterloo, Waterloo, ON, Canada

- Supervised three sections of the first-year mechanics laboratory course for Biology and Chemistry majors in the Fall 2014 and Fall 2015 terms; graded students' lab reports.

Math & Physics Learning Assistant
2011–2012

Sheridan College, Brampton, ON, Canada

- Conducted weekly tutorials for four sections of the first-semester Math course for engineering students.

- Prepared and graded weekly quizzes administered during the tutorial.

- Conducted appointments and drop-in tutoring sessions to assist students with Math and Physics coursework questions.

GRANTS & AWARDS

- Unfunded collaborator on the Multidisciplinary University Research Initiative (MURI) grant entitled: "Robust entanglement distribution in quantum networks – network science and architectures for novel quantum information processing".
    - Joint collaboration between UCLA, Stanford, Virginia Tech, UC Boulder, Caltech, and Louisiana State University (LSU).
    - Helped write the grant proposal for LSU's contribution.

Title	Duration
APS Brazil-US Student & Postdoc Visitation Program	November 2019
NSERC Postgraduate Scholarship—Doctoral	2018–2021
Quantum Computing Summer School Fellowship (LANL)	Summer 2018
Ontario Graduate Scholarship	2015–2016
NSERC Canada Graduate Scholarship—Master's	2014–2015
President's Graduate Scholarship	2014–2016
Marie Curie Award	2014–2016
NSERC Undergraduate Student Research Award ($\times$ 2)	2012, 2014

TECHNICAL SKILLS

- Creator of the Python package QuTIpy.

- **Programming languages:** Python, Matlab/Octave, LaTeX

- **Software:** Matlab/Octave, Maple, Mathematica

- **Quantum computing packages:** pyQuil (Rigetti), Qiskit (IBM)

ACADEMIC SERVICE

- Program committee member for Quantum Computing Theory in Practice (QCTiP) 2024.

- Program committee member for the Sixth International Conference for Young Quantum Information Scientists (6-YQIS 2021).

- Program committee co-chair for the First QWorld Quantum Science Days 2021.

- Reviewing for journals.
    - IEEE Transactions on Information Theory
    - Quantum Information Processing
    - Reviews in Mathematical Physics
    - New Journal of Physics
    - Quantum
    - Communications Physics
    - PRX Quantum
    - Physical Review A (PRA)
    - npj Quantum Information
    - Physical Review Letters (PRL)
    - Quantum Science and Technology
    - Quantum Machine Intelligence
    - Physical Review Research