Felix Leditzky

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Nationality	Austrian

Employment

Jan 2021 – present	**Assistant Professor** (tenure-track) Department of Mathematics, University of Illinois at Urbana-Champaign
Dec 2019 – Dec 2020	**Postdoctoral Fellow** Institute for Quantum Computing, University of Waterloo Perimeter Institute for Theoretical Physics
Nov 2016 – Nov 2019	**Postdoctoral Research Associate** JILA, University of Colorado Boulder

Education

Oct 2013 – Oct 2016	**PhD**, University of Cambridge Thesis: "Relative entropies and their use in quantum information theory" Supervised by Nilanjana Datta
Oct 2006 – Apr 2013	**Diploma in Physics** (Mag. rer. nat.), University of Vienna Thesis: "Deformed $\mathbb{R}^3$ as a physical framework for quantum mechanical problems" Supervised by Harald Grosse (graduated with distinction)
Oct 2006 – Feb 2012	**Diploma in Mathematics** (Mag. rer. nat.), University of Vienna Thesis: "Principal indecomposable modules for the Alternating group on five symbols in modular characteristic" Supervised by Joachim Mahnkopf (graduated with distinction)

Research interests

Quantum information theory, in particular mathematical and computational aspects

- additivity problems in quantum information theory, quantum channels and their capacities, quantum Shannon theory, mathematics of relative entropies, strong converse theorems, second order asymptotics
- multipartite entanglement, neural networks and tensor networks ansätze for many-body quantum states, symmetries and representation theory, group theory
- semidefinite programming, convex optimization theory, machine learning techniques, global optimization techniques

Publications & preprints

[21] C. Hirche and F. Leditzky. "Bounding quantum capacities via partial orders and complementarity". *arXiv preprint* (2022). arXiv: 2202.11688 [quant-ph]

[20] F. Leditzky, D. Leung, V. Siddhu, G. Smith, and J. A. Smolin. "The platypus of the quantum channel zoo". *arXiv preprint* (2022). arXiv: 2202.08380 [quant-ph]

[19] F. Leditzky, D. Leung, V. Siddhu, G. Smith, and J. A. Smolin. "Generic nonadditivity of quantum capacity in simple channels". *arXiv preprint* (2022). arXiv: 2202.08377 [quant-ph]

[18] A. Shlosberg, A. J. Jena, P. Mukhopadhyay, J. F. Haase, F. Leditzky, and L. Dellantonio. "Adaptive estimation of quantum observables". *arXiv preprint* (2021). arXiv: 2110.15339 [quant-ph]

[17] F. Leditzky. "Optimality of the pretty good measurement for port-based teleportation". *arXiv preprint* (2020). arXiv: 2008.11194 [quant-ph]

[16] R. Arnon-Friedman and F. Leditzky. "Upper bounds on device-independent quantum key distribution rates and a revised Peres conjecture". *IEEE Transactions on Information Theory* 67.10 (2021), pp. 6606–6618. arXiv: 2005.12325 [quant-ph]

[15] J. Bausch and F. Leditzky. "Error Thresholds for Arbitrary Pauli Noise". *SIAM Journal on Computing* 50.4 (2021), pp. 1410–1460. arXiv: 1910.00471 [quant-ph]

[14] E. I. Rosenthal, C. M. F. Schneider, M. Malnou, Z. Zhao, F. Leditzky, B. J. Chapman, W. Wustmann, X. Ma, D. A. Palken, M. F. Zanner, L. R. Vale, G. C. Hilton, J. Gao, G. Smith, G. Kirchmair, and K. W. Lehnert. "Efficient and Low-Backaction Quantum Measurement Using a Chip-Scale Detector". *Physical Review Letters* 126.9 (2021), p. 090503. arXiv: 2008.03805 [quant-ph]

[13] M. Christandl, F. Leditzky, C. Majenz, G. Smith, F. Speelman, and M. Walter. "Asymptotic performance of port-based teleportation". *Communications in Mathematical Physics* 381 (2021), pp. 379–451. arXiv: 1809.10751 [quant-ph]

[12] F. Leditzky, M. A. Alhejji, J. Levin, and G. Smith. "Playing Games with Multiple Access Channels". *Nature Communications* 11, 1497 (2020). arXiv: 1909.02479 [quant-ph]

[11] J. Bausch and F. Leditzky. "Quantum codes from neural networks". *New Journal of Physics* 22.2, 023005 (2020). arXiv: 1806.08781 [quant-ph]

[10] F. Leditzky, D. Leung, and G. Smith. "Dephrasure Channel and Superadditivity of Coherent Information". *Physical Review Letters* 121.16 (2018), p. 160501. arXiv: 1806.08327 [quant-ph]

[9] F. Leditzky, N. Datta, and G. Smith. "Useful states and entanglement distillation". *IEEE Transactions on Information Theory* 64.7 (2018), pp. 4689–4708. arXiv: 1701.03081 [quant-ph]

[8] F. Leditzky, D. Leung, and G. Smith. "Quantum and Private Capacities of Low-Noise Channels". *Physical Review Letters* 120.16 (2018), p. 160503. arXiv: 1705.04335 [quant-ph]

[7] F. Leditzky, E. Kaur, N. Datta, and M. M. Wilde. "Approaches for approximate additivity of the Holevo information of quantum channels". *Physical Review A* 97.1 (2018), p. 012332. arXiv: 1709.01111 [quant-ph]

[6] F. Leditzky, C. Rouzé, and N. Datta. "Data processing for the sandwiched Rényi divergence: a condition for equality". *Letters in Mathematical Physics* 107.1 (2017), pp. 61–80. arXiv: 1604.02119 [quant-ph]

[5] S. Beigi, N. Datta, and F. Leditzky. "Decoding Quantum Information via the Petz recovery map". *Journal of Mathematical Physics* 57.8, 082203 (2016). arXiv: 1504.04449 [quant-ph]

[4] F. Leditzky, M. M. Wilde, and N. Datta. "Strong converse theorems using Rényi entropies". *Journal of Mathematical Physics* 57.8, 082202 (2016). arXiv: 1506.02635 [quant-ph]

[3] F. Leditzky and N. Datta. "Second order asymptotics of visible mixed quantum source coding via universal codes". *IEEE Transactions on Information Theory* 62.7 (2016), pp. 4347–4355. arXiv: 1407.6616 [quant-ph]

[2] N. Datta and F. Leditzky. "Second-Order Asymptotics for Source Coding, Dense Coding, and Pure-State Entanglement Conversions". *IEEE Transactions on Information Theory* 61.1 (2015), pp. 582–608. arXiv: 1403.2543 [quant-ph], N. Datta and F. Leditzky. "Corrections to "Second-Order Asymptotics for Source Coding, Dense Coding, and Pure-State Entanglement Conversions"". *IEEE Transactions on Information Theory* 64.4 (2017), pp. 2625–2627

[1] N. Datta and F. Leditzky. "A limit of the quantum Rényi divergence". *Journal of Physics A: Mathematical and Theoretical* 47.4 (2014), p. 045304. arXiv: 1308.5961 [quant-ph]

Grants, Awards & Scholarships

Jan 2022 – Dec 2024	National Science Foundation Grant "QL-The Quantum Leap: Leading the Next Quantum Revolution" (Co-Principal Investigator) "QuIC-TAQS: Quantum Networking with Multipartite Entangled Photons" PI: Shuo Sun (University of Colorado Boulder), Co-PIs: Edwin Barnes (Virginia Tech), Felix Leditzky, Paul Kwiat (UIUC) Amount: $2,499,999
Aug 2021 – Aug 2023	IBM-Illinois Discovery Accelerator Institute Grant (Principal Investigator) "Efficient implementation of optimal measurements in state discrimination" PIs: Srinivasan Arunachalam (IBM), Eric Chitambar, Felix Leditzky (UIUC) Amount: $346,287
Aug 2018	National Science Foundation Grant CCF 1834515 (Principal Investigator) Travel support for workshop *Rocky Mountain Summit on Quantum Information* Co-PI: Graeme Smith Amount: $10,000
May 2018	AI Grant (together with Johannes Bausch) "Search for new quantum error correction codes using neural networks" Amount: $2,500 plus $20,000 GPU credits.
Apr 2015	Smith-Knight and Rayleigh-Knight Prize (essay) "Source coding for a mixed source: determination of second order asymptotics" Amount: £250
Oct 2013 – Sep 2016	Maintenance grant, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge EPSRC grant covering College and University fees
Jan 2009	Performance scholarship, University of Vienna
Jan 2008	Performance scholarship, University of Vienna

Teaching experience

University of Illinois at Urbana-Champaign

Spring term 2022	Illinois Geometry Lab project on Select topics in quantum information theory (Undergraduate research project, 16 students)
Fall term 2021	Abstract Linear Algebra

Spring term 2021 Quantum channels I & Quantum channels II

University of Cambridge

Oct 2015 – Dec 2015 Exercise classes for lecture "Quantum Information Theory"
Oct 2014 – Dec 2014 Exercise classes for lecture "Quantum Information Theory"
Oct 2013 – Dec 2013 Exercise classes for lecture "Quantum Information Theory"

Extended research visits

Mar 2019 Kavli Institute for Theoretical Physics, Santa Barbara, CA, USA
Program "Machine Learning for Quantum Many-Body Physics"
Dec 2017 Kavli Institute for Theoretical Physics, Santa Barbara, CA, USA
Program "Quantum Physics of Information"
Sep 2017 Institute Henri Poincaré, Paris, France
Program "Analysis in Quantum Information Theory"

Presentations

Contributed talks

† Talk given online due to COVID-19 pandemic. * Talk delivered by co-author.

Mar 2022* *Quantum Information Processing*, Pasadena, USA
Title: "The platypus of the quantum channel zoo"
Sep 2021†* *Beyond I.I.D. in Information Theory*, Taipei, Taiwan
Title: "The platypus of the quantum channel zoo"
Aug 2021† *International Congress on Mathematical Physics*, Geneva, Switzerland
Title: "Asymptotic performance of port-based teleportation"
Jul 2021† *Theory of Quantum Computation, Communication and Cryptography*, Riga, Latvia
Title: "Upper bounds on device-independent quantum key distribution rates"
Nov 2020† *Beyond I.I.D. in Information Theory*, Stanford, USA
Title: "Playing games with multiple access channels"
Nov 2020†* *Beyond I.I.D. in Information Theory*, Stanford, USA
Title: "Upper bounds on device-independent quantum key distribution rates and a revised Peres conjecture"
Jun 2020† *Theory of Quantum Computation, Communication and Cryptography*, Riga, Latvia
Title: "Playing games with multiple access channels"
Jan 2020 *Quantum Information Processing*, Shenzhen, China
Title: "Error thresholds for arbitrary Pauli noise"
Jul 2019 *Beyond I.I.D. in Information Theory*, Sydney, Australia
Title: "Quantum codes from neural networks"
Feb 2019 *Southwest Quantum Information and Technology*, Albuquerque, USA
Title: "Dephrasure channel and superadditivity of coherent information"
Jan 2019* *Quantum Information Processing*, Boulder, USA
Title: "Asymptotic performance of port-based teleportation"
Jul 2018 *Beyond I.I.D. in Information Theory*, Cambridge, UK

Title: "Dephrasure channel and superadditivity of coherent information"

Jul 2017 *Beyond I.I.D. in Information Theory*, Singapore, Singapore
Title: "Useful states and entanglement distillation"

Jun 2017 *IEEE International Symposium on Information Theory*, Aachen, Germany
Title: "Degradable states and one-way entanglement distillation"

Jul 2016 *IEEE International Symposium on Information Theory*, Barcelona, Spain
Title: "Strong converse theorem for state redistribution using Rényi entropies"

Sep 2015 *Quantum Information Processing and Communication*, Leeds, UK
Title: "Second Order Asymptotics of Quantum Mixed Source Coding"

Invited talks

Nov 2021 Mathematics Colloquium, University of South Carolina, USA
Title: "Symmetries in quantum information theory"

Oct 2020 *Recent developments in quantum information and computing*, The Graduate Center, City University of New York, USA
Title: "Symmetries and asymptotics of port-based teleportation"

Jul 2020 *Tutte Colloquium*, Department of Combinatorics & Optimization, University of Waterloo, Canada
Title: "Symmetries and asymptotics of port-based teleportation"

Sep 2019 *57th Annual Allerton Conference on Communication, Control and Computing*, University of Illinois Urbana-Champaign, Monticello, USA
Title: "Quantum codes from neural networks"

Jul 2019 *Algebraic and Statistical ways into Quantum Resource Theories* (BIRS workshop), Banff, Canada
Title: "Asymptotic performance of port-based teleportation"

May 2019 *Symposium on Quantum resources and their application*, ICTQT & KCIK, Gdansk, Poland
Title: "Quantum Codes from Neural Networks"

Oct 2018 *Quantum Innovators in computer science and mathematics*, IQC, University of Waterloo, Canada
Title: "Quantum Codes from Neural Networks"

Apr 2018 *IQC Colloquium*, IQC, University of Waterloo, Canada
Title: "Asymptotic performance of port-based teleportation"

Nov 2017 *IEEE Information Theory Workshop*, Kaohsiung, Taiwan
Title: "Quantum and private capacities of low-noise channels"

Aug 2015 *Young Researchers in Mathematics*, University of Oxford, UK
Title: "Second Order Asymptotics in Quantum Information Theory: Quantum Source Coding"

Jul 2015 *Beyond I.I.D. in Information Theory*, Banff, Canada
Title: "Strong converse theorems using Rényi entropies"

Aug 2014 *QUTE-Europe Summer School*, Smolenice, Slovakia
Title: "Source coding for a mixed source: determination of second order asymptotics"

Poster presentations

Feb 2019 *Southwest Quantum Information and Technology*, Albuquerque, USA

Title: "Quantum codes from neural networks"

Jan 2019 *Quantum Information Processing*, Boulder, USA
Title: "Quantum codes from neural networks"

Jul 2018 *Beyond I.I.D. in Information Theory*, Cambridge, UK
Title: "Port-based teleportation in arbitrary dimension – asymptotics and a converse bound"

Jan 2018 *Quantum Information Processing*, Delft, Netherlands
Title: "Bounds on quantum channel capacities from approximate additivity of channel information quantities"
Title: "Quantum and private capacities of low-noise channels"

Jan 2017 *Quantum Information Processing*, Seattle, USA
Title: "Degradable states and one-way entanglement distillation"

Jul 2016 *Beyond I.I.D. in Information Theory*, Barcelona, Spain
Title: "Degradable states: Upper bounds on one-way distillable entanglement and quantum capacity"

Jan 2016 *Quantum Information Processing*, Banff, Canada
Title: "Strong converse theorems using Rényi entropies"

Feb 2014 *Quantum Information Processing*, Barcelona, Spain
Title: "A limit of the quantum Rényi divergence"

Seminar talks

May 2021 *IQUIST Young researcher seminar*, University of Illinois at Urbana-Champaign, USA
Title: "Entanglement in quantum communication"

Mar 2021 *Quasar seminar*, University of Ottawa, Canada
Title: "Symmetries and asymptotics of port-based teleportation"

Apr 2020 *ICTQT Seminar*, ICTQT/KCIK, University of Gdansk, Poland
Title: "Playing games with multiple access channels" (remote talk)

Mar 2020 *IQUIST Seminar*, University of Illinois Urbana-Champaign, USA
Title: "Symmetries and entanglement in channel coding problems" (remote talk)

Feb 2020 *IQC Seminar*, IQC, University of Waterloo, Canada
Title: "Error thresholds for arbitrary Pauli noise"

Jan 2020 *KdVI Seminar*, Korteweg-de Vries Institute for Mathematics, University of Amsterdam, Netherlands
Title: "Symmetries and entanglement in channel coding problems"

Nov 2019 *QuICS Seminar*, QuICS, University of Maryland, USA
Title: "Playing games with multiple access channels"

Sep 2019 *IQUIST Seminar*, University of Illinois Urbana-Champaign, USA
Title: "Symmetries and asymptotics of port-based teleportation"

Mar 2019 *Machine Learning for Quantum Many-Body Physics*, KITP, University of California Santa Barbara, USA
Title: "Quantum codes from neural networks"

Nov 2018 *CQIF group seminar*, University of Cambridge, UK
Title: "Asymptotic performance of port-based teleportation"

Sep 2018 *IQOQI Seminar*, Austrian Academy of Sciences & University of Vienna, Austria
Title: "Dephrasure channel and superadditivity of coherent information"

Jun 2018 *Stanford University Seminar*, Stanford University, USA

Title: "Dephrasure channel and superadditivity of coherent information"

May 2018 *MIT Seminar*, Massachussetts Institute of Technology, USA
Title: "Asymptotic performance of port-based teleportation"

May 2018 *PI Seminar*, Perimeter Institute for Theoretical Physics, Canada
Title: "Asymptotic performance of port-based teleportation"

Jan 2018 *QuSoft Seminar*, QuSoft, University of Amsterdam, Netherlands
Title: "Useful states and entanglement distillation, and a toy channel exhibiting superadditivity of coherent information"

Nov 2017 *Hunter College group seminar*, City University of New York, USA
Title: "Bounds on quantum channel capacities from approximate additivity of channel information quantities"

Sep 2017 *Analysis in Quantum Information Theory: Junior research seminar*, IHP, Paris, France
Title: "Bounds on quantum channel capacities from approximate additivity of channel information quantities"

Jul 2017 *IQI Seminar*, Caltech, USA
Title: "Useful states and entanglement distillation"

May 2017 *LSU group seminar*, Louisiana State University, USA
Title: "On the quantum capacity of the qubit depolarizing channel"

May 2017 *LSU group seminar*, Louisiana State University, USA
Title: "Relative entropies and their use in quantum information theory"

Apr 2017 *CTQM seminar*, University of Colorado Boulder, USA
Title: "Upper bounds on the one-way and two-way distillable entanglement from suitable convex decompositions"

Apr 2017 *CQIF group seminar*, University of Cambridge, UK
Title: "On the quantum capacity of the qubit depolarizing channel"

Feb 2016 *CAKE seminar*, University of Cambridge, UK
Title: "Equality condition in the data processing inequality for the quantum relative entropy"

Jan 2016 IBM Thomas J. Watson Research Center, Yorktown Heights, USA
Title: "Strong converse theorems using Rényi entropies"

Academic service

Conference organization

Aug 2021 – Jul 2022 Organizer of the conference *Theory of Quantum Computation, Communication, and Cryptography (TQC) 2022* held at University of Illinois at Urbana-Champaign, USA, July 11-14, 2022.
Co-organizers: Eric Chitambar, Emily Edwards.
Website: https://tqc2022-conference.iquist.illinois.edu/

Jan 2018 – Jan 2019 Organizer of the conference *Quantum Information Processing (QIP) 2019* held at University of Colorado Boulder, USA, January 14-18, 2019.
Co-organizer: Graeme Smith.
Website: http://jila.colorado.edu/qip2019

Nov 2017 – Jun 2018 Organizer of the workshop *Rocky Mountain Summit on Quantum Information* held at JILA, University of Colorado Boulder, USA, June 25-29, 2018.
Co-organizers: Graeme Smith, Mark M. Wilde.

Website: http://jila.colorado.edu/rmsqi

Editorial and referee services

Feb 2022 – Mar 2022	Member of program committee for conference *TQC 2022*. Website: https://tqc2022-conference.iquist.illinois.edu/
Aug 2021	Member of program committee for conference *Beyond IID in Information Theory*. Website: http://cc.ee.ntu.edu.tw/~beyondiid9/
Mar 2021 – Apr 2021	Member of program committee for conference *TQC 2021*. Website: https://tqc2021.lu.lv/call-for-papers/
Nov 2020 – present	Editor for *Illinois Journal of Mathematics*.
Oct 2013 – present	Reviewing for: *IEEE Transactions on Information Theory*, *Communications in Mathematical Physics*, *Journal of Mathematical Physics*, *Mathematical Programming*, *Physical Review Letters*, *Physical Review A*, *Nature Physics*, *Nature Communications*, *npj Quantum Information*, *New Journal of Physics*, *Quantum*, *Quantum Information Processing*, various conferences (*ISIT*, *ITW*, *QIP*, *TQC*, *AQIS*, *CEQIP*, *Q-Turn*, *STOC*).
April 2018	Member of program committee for conference *CEQIP 2018*. Website: http://ceqip.eu/2018/index.php

Miscellaneous

Aug 2020 – Dec 2020	Organization of the quantum information group seminar at Perimeter Institute for Theoretical Physics
Oct 2014 – Jun 2015	Vice-President of the post-graduate community (MCR) of Girton College, University of Cambridge
Oct 2013 – Jun 2014	Social Secretary of the post-graduate community (MCR) of Girton College, University of Cambridge

Language & IT skills

Languages	German (native), English (fluent), Spanish (conversational), Latin (translation)
IT	Matlab, Mathematica, Python, HTML, CSS, Linux, LaTeX

Interests

Music, playing guitar, reading, playing football, running, traveling

References

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