

Barbara Kraus

Curriculum Vitae

Technical University of Munich
School of Natural Sciences
Department of Physics
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Personal Details

Date of birth	December 26, 1975
Place of birth	Innsbruck, Austria
Citizenship	Austria

Education

Oct. 2003	Diploma in Mathematics (with distinction) University of Innsbruck
Feb. 2003	PhD in Physics (with distinction) University of Innsbruck
Sep. 1999	Diploma in Physics (with distinction) University of Innsbruck
1994-1999	Studies of Physics and Mathematics University of Innsbruck

Professional Experience

2023-today	Full Professor Technical University of Munich, Germany (Chair for Quantum Algorithms and Applications, endowed by BMW)
08/2021-12/2022	Head of the Institute for Theoretical Physics University of Innsbruck
2020-2022	Full Professor University of Innsbruck
2013-2020	Associate Professor University of Innsbruck
2010-2013	Assistant Professor University of Innsbruck
2006-2010	Senior Postdoctoral researcher University of Innsbruck

Fellowships and Awards

2004-2006	Postdoctoral researcher Group of Applied Physics, University of Geneva (CH)
2003	Postdoctoral researcher Max-Planck-Institute for Quantum Optics, Garching (DE)
2022	Helmholtz Distinguished Professorship (declined) Zeuthen, Germany
2019	Forschungspreis der Stiftung Südtiroler Sparkasse
2013	Ignaz L. Lieben award of the Austrian Academy of Sciences
2011	Boltzmann prize of the Austrian Physical Society
2010	START price of the FWF (Austrian Science fund) and the BMWF
2006-2010	Senior PostDoc grant Elise Richter of the FWF (Austrian Science Fund) at the Institute of Theoretical Physics, University of Innsbruck
2006	Apart Grant (Austrian Programme for Advanced Research and Technology) – declined by B.K.

Funding

2022	EU – Horizon Europe (HEU), Cluster 4: Digitalisierung, Industrie & Weltraum Title: QCFD Quantum Computational Fluid Dynamics Amount of funding: approx. 4.900.000€ for 4 years and 6 research facilities
2019	Joint research group with JKU Linz and UNIVIE Title: Multiphoton Experiments with Semiconductor Quantum Dots Amount of funding: approx. 1.500.000€ for 5 years, in 2023 transferred to Prof. Ritsch, due to move to TUM
2019	FWF Standalone Project Title: Physical approach towards multipartite entanglement Amount of funding: approx. 414.000€ for 4 years
2019 (4+4)	SFB BeyondC (Quantum Information Systems Beyond Classical Capabilities) Speaker: Philip Walther (UNIVIE), Deputy Speaker: Barbara Kraus Amount of funding: approx. 5.000.000€ for first funding period (4 years) and 12 PIs, second funding period granted, in 2023 transferred to Prof. Küng and Dr. Kraft, due to move to TUM

2018-2020	Innovation Fund “Research, Science and Society” of the Austrian Academy of Sciences (ÖAW) Title: Operational Entanglement Amount of funding: approx. 270.000€ for 2 years
2015 (4+4)	Doctoral Programme (Doktoratskolleg) Atoms, Lights, and Molecules (beginning 2016 with positive evaluation 2019) Amount of funding: approx. 6.500.000€ for 8 years and 13 PIs
2010-2016 (3+3)	START FWF Title: Novel Theoretical Tools for Quantum Many Body Systems Amount of funding: approximately 1.200.000€ for 6 years
2008-2012	SFB FoQuS (Foundations and Applications of Quantum Science) Co-Pi (PI Prof. Hans-Jürgen Briegel), Project P11 Amount of funding for P11: approx. 360.000€ for 4 years
2006-2010 (2+2)	Elise-Richter grant FWF Title: Quantum Complexities and Quantum Interfaces Senior PostDoc grant

Referee Activity

Referee for:

- PNAS
- Royal Society A: Mathematical, Physical & Engineering Sciences
- Nature Physics
- Physical Review Letters
- Physical Review A
- New Journal of Physics
- Journal of Physics A: Mathematical and Theoretical, Quantum Information and Computation
- Journal of Complexity
- Optics Communications
- 2012 Outstanding Referee of the Physical Review and Physical Review Letters journals

Membership of Scientific Committees

- Member of the Steering committee QIP 2024: 27th Annual Conference on Quantum Information Processing, Taipei, Taiwan (2024)
- Member of selection committee for young scientists to attend the 73rd Lindau Nobel Laureate Meeting dedicated to Physics, Lindau, Germany (2023)
- Member of the Steering committee QIP 2023: 26th Annual Conference on Quantum Information Processing, Ghent University, Belgium (2023)
- Member of the Steering committee QIP 2022: 25th Annual Conference on Quantum Information Processing, California Institute of Technology (Caltech), Pasadena CA, USA (2022)
- Scientific Committee Member (E. Solano (Univ. Basque Country), G. K. Brennen (Macquarie Univ.), B. Kraus (Univ. Innsbruck), Ch. Wilson (IQC), J. I. Latorre (Univ. Barcelona): Quantum Simulation and Computation, Bilbao, Spain (February 2018)
- Member of Committee of L'ORÉAL- grant (2016, 2018)

- Member of advisory board of qualification agreement (Mathematics, Informatics and Physics), (since 2014)
- Program Committee Member: QIP 2014, 17th conference on Quantum Information Processing, Barcelona (February 2014)
- Program Committee Member: TQC 2012, 7th Conference on Theory of Quantum Computation, Communication, and Cryptography, Tokyo, Japan (May 2012)
- Program Committee Member: QIP 2011, 14th Workshop on Quantum Information Processing, Singapore (January 2011)

Committees and External Examiner

- Tenure-Track Evaluation: Menno Poot (2023), Technische Universität München
- Appointment committee, AI-based Materials Science (2023), Technische Universität München
- Habilitation committee Dr. Miguel Navascués Cobo (2023), University of Vienna
- Appointment committee: Professorship: "Quanteninformation und Quantenthermodynamik" (2022), University of Vienna
- Appointment committee "Tenure-Track position: Astrophysics" (2022), University of Innsbruck
- Habilitation committee Dr. Markus Müller (2021), University of Vienna
- External committee: 2020 ICFO PhD Zahra Raissi (2020)
- Hiring committee: Professorship: "Numerical analysis of Synthetic Quantum Matter", University of Cologne in collaboration with the Research Center Jülich (FZJ) (2018)
- Member of the Steering committee DK ALM (2016-2022), University of Innsbruck
- External thesis examiner: University of Vienna (2x), Complutense de Madrid (1x), Universidad Autónoma de Madrid (1), University of Barcelona, Spain (1x), University of Aarhus, Denmark (1x), University of Technology Sydney, Australia (1x), Jagiellonian University, Poland (1x)
- Habilitation committee Dr. Ana Predrojevic (2015), University of Innsbruck
- Habilitation committee Dr. Hashem Zoubi (2014), University of Innsbruck
- Habilitation committee Dr. Markus Hennrich (2012), University of Innsbruck
- Appointment committee (§99): Professorship (IQQQI) for Theoretical Physics (2011-2012), Innsbruck
- Hiring committee (§99): Professorship (IQQQI) for Experimental Physics (2011-2012), Innsbruck
- Hiring committee Theoretical Physics: Bio-Nano-Physics (2011-2012), Innsbruck
- Habilitation committee Dr. Stephan Denifl (2011), University of Innsbruck

Further Activities

- 2014 member of the Editorial Board of Physical Review Letters
- 2014-2023 member of Young Academy of the Austrian Academy of Science
- 2015-2021 member of editorial board of Physical Review A
- 2016-2019 member of directorial board of the Young Academy of the Austrian Academy of Science

Postdocs of Research Group

- Matthias Englbrecht (2023-ongoing)
- Tristan Kraft (2021-ongoing)
- Cornelia Spee (2021)
- Jose Carrasco (2019-2022)
- Antoine Neven (2019-2021)
- Farid Shahandeh (2018)
- Tatjana Carle (2013)

- Michalis Skotiniotis (2013)
- Marti Cuquet (2012-2015)
- Christoph Spengler (2012-2013)
- Julio de Vicente (2010-2012)

Supervision of Doctoral Theses

- Tobias Olsacher (2024-ongoing)
- Daniel Molpeceres Mingo (2023-ongoing)
- Marc Langer (2022-ongoing)
- Kai Hong Li (2020-2023, not completed)
- David Gunn (2018-ongoing)
- Matthias Englbrecht (2018-2023)
- Martin Hebenstreit (2016-2020)
- David Sauerwein (2015-2019)
- Katharina Schwaiger (2014-2018)
- Walter Boyajian (2012-2016)
- Cornelia Spee (2012-2016)
- Tatjana Carle (2009-2013)

Student Assistant

- Chenshuo Ma (2023-2024)

Supervision of Master Theses

- Lukas Haller (2024-ongoing)
- Michael Hämmerle (2021, cancelled)
- Thomas Klüter (2021, cancelled)
- Marc Langer (July 2021)
- Eda Harmanci (February 2021)
- Albert Rico (October 2020)
- Leonhard Czarnetzki (March 2019)
- Raphael Brieger (May 2018)
- Yaiza Aragones (April 2018)
- Martin Hebenstreit (December 2015)
- David Sauerwein (December 2014)
- Katharina Schwaiger (September 2013)
- Clemens Streitberger (January 2013)
- Co-Supervision: David Gschliesser (Supervisor: Univ. Prof. Dr. Hans. J. Briegel, 2009)

Supervision of Bachelor Theses

- Paul Aigner (2022)
- Florian Boenke (2022)
- Eva Halbartschlager (2022)
- Florian Langgartner (2019)
- Callum Carver (2019)
- Benjamin Stütz (2018)
- Elias Starchl (2018)
- David Drexler (2017)

- Rene Lampert (2017)
- Sandro Huber (2016)
- Alexander Prantner (2015)
- Benjamin Seethaler (2015)
- Eve Partoll (2013)
- Christian Romen (2011)
- Thomas Förg-Rob (2011)

Invited Talks

- 65) Verification of quantum computation and quantum simulation", MCQST, CalBay Summerschool, June 2024
- 64) *Verification of quantum computations and simulations*, Quantum Matter International Conference – QUANTUMatter 2024, San Sebastian, Spain, May 2024
- 63) *Gaining confidence in quantum devices*, QCfD workshop, Hamburg, Germany, March 2024
- 62) *Phases of Matrix Product States with Symmetric Quantum Circuits and Symmetric Measurements with Feedforward*, international workshop on Quantum Interactive Dynamics, qid24, Dresden, Germany, March 2024
- 61) *Methods to test quantum computation and quantum simulations*, workshop on Quantum Information, Les Diableretes, Switzerland, February 2024
- 60) *Testing and verifying quantum devices* (keynote), ECQT Conference 2023, Hannover, Germany, October 2023
- 59) *Towards physically relevant multipartite entanglement* (keynote), ML4Q Conference 2023, Königswinter, Germany, September 2023
- 58) *Using match gates to Gain confidence in the correct realization of arbitrary quantum computations*, International Quantum Tensor Network, Burghausen, Germany, July 2023
- 57) *On the verification of quantum computations*, Beyond IID in Information Theory, Tübingen, Germany, July 2023
- 56) *Gaining confidence in the correct realization of arbitrary quantum computations*. MCQST Conference, Sonthofen, Germany, June 2023
- 55) *Towards the verification of quantum devices*, International Focus Workshop "Simulating Quantum Many-Body Systems on Noisy Intermediate-Scale Quantum Computers" (NISQ22), MPIPKS, Dresden, Germany, April 2022
- 54) *Protocols for testing and verifying quantum devices – theory and experiment*, ICQIF-2022, Kolkata, India (online), February 2022
- 53) *Symmetries and entanglement of physically relevant classes of multipartite states*, 40+1 anniversary of Center for Theoretical Physics PAN, Warsaw, Poland (online), September 2021
- 52) *Testing and verifying quantum devices*, MCQST2021, Munich, Germany (online), July 2021

- 51) *On Characterization, Validation, and Verification of Quantum Devices*, CPT Quantum Information Days, Warsaw, Poland (online), February 2021
- 50) *On Characterization, Validation, and Verification of Quantum Devices*, SFB BeyondC Winter Workshop 2021, (online), February 2021
- 49) *Some aspects of quantum computing and its verification*, BQIT:20, Bristol, (online), April 2020
- 48) *Some Aspects of Quantum Computing and Verification and Validation of Quantum Computing*, International Focus Workshop " Simulating Quantum Many-Body Systems on Noisy Intermediate-Scale Quantum Computers", Dresden, (online), March 2020
- 47) *From compressible to universal quantum computation*, 3RD QSC General Assembly, Amsterdam, Netherlands, December 2019
- 46) *Symmetries and entanglement of classes of multipartite states*, Quantum Information Theory, ICMAT Madrid, Spain, September 2019
- 45) *All Pure fermionic non-Gaussian states are magic states for matchgate computations*, ÖPG-SPG Tagung, Zürich, Switzerland, August 2019
- 44) *From Compressible to universal Quantum computation*, X Jubilee SYMPOSIUM KCIKI Symposium ICTQT-KCIK "Quantum Resources and Their Application", Sopot, Poland, May 2019
- 43) *Entanglement and symmetries of multipartite systems & Magic states for Quantum computation*, Workshop: Operator Algebras, Groups and Applications to Quantum Information, Madrid, Spain, May 2019
- 42) *Entanglement and / in quantum computation*, ICFO-IMPRS joint workshop on Quantum Technologies, ICFO, Castelldefels, Spain, March 2019
- 41) *Local manipulation of entanglement*, The Mathematics of Quantum Information, Siegen, Germany March 2019
- 40) *Entanglement & Compressed quantum computation*, SFB-FoQuS International Conference, Innsbruck, February 2019
- 39) *Sorting and quantifying multipartite entanglement & Compressed quantum computation*, Heraeus Seminar on Scalable Hardware Platforms for Quantum Computing, Bad Honnef, Germany, January 2019
- 38) *Local transformations of multipartite entanglement*, conference: AQIS, 18th Asian Quantum Information Science Conference, Nagoya, Japan, September 2018
- 37) *Multipartite Pure State Transformations*, conference: "Entanglement in Quantum Systems", Florence, Italy, June 2018
- 36) *Multipartite SLOCC and LOCC transformations*, workshop: Mathematics of Quantum Information, Cambridge, UK, May 2018
- 35) *Local manipulation of multipartite entanglement*, APS march meeting, Los Angeles, USA, March 2018
- 34) *Some aspects of multipartite entanglement*, Quantum optics conference, Obergurgl, Austria, February 2018

- 33) *Non-trivial local Transformations among pure entangled states almost never exist*, Bad Honnef, Germany, December 2017
- 32) *New insights into SLOCC & LOCC transformations among multipartite pure states*, Trieste, Italy, September 2017
- 31) *International Conference on Quantum Communication, Measurement and Computing (QCMC)*, Singapore, July, 2016 (transferred to Katharina Schwaiger)
- 30) *Quantum information and some of its Applications*, Imagine16 (era of great ideas), Innsbruck, June 2016
- 29) *Some aspects of multipartite entanglement*, XIV International Conference on Quantum Optics and Quantum Information, Minsk, Belarus, October 2015 (declined due to case of death)
- 28) *Maximally Entangled Sets and operational characterization of few-body entanglement*, 7th Italian Quantum Information Science Conference (IQIS2014), Salerno, Italy, September 2014
- 27) *Maximally Entangled Sets & New approach to entanglement quantification*, Quantum [Un]Speakables II: 50 Years of Bell's Theorem, Vienna, Austria, June, 2014
- 26) *Maximally entangled states*, Quantum 2014 - Workshop ad memoriam of Carlo Novero, Advances in Foundations of Quantum Mechanics and Quantum Information with atoms and photons, Turin, Italy, May 2014
- 25) *Maximally entangled states*, Entanglement detection and quantification, Bilbao, Spain, March 2014
- 24) *Quantum Information Theory: Entanglement and compressed quantum computing*, Symposium on contemporary physics, Würzburg, February 2014
- 23) *Maximally entangled sets*, Joint Annual Meeting of ÖPG, SPG, ÖGAA und SGAA, Linz, Austria, September, 2013
- 22) *Few qubit entanglement, Workshop: The Greatest Inspiration Surely Is Nonlocality* (Nicolas Gisin's 60th birthday), Les bains du Val d'Illiez, Switzerland, June, 2012
- 21) *Compressed quantum Computation and quantum Simulation*, International Conference on Quantum Optics, Obergurgl, Austria, February, 2012
- 20) *Dissipative state preparation and compressed quantum computation*, International Workshop on Engineering and Control of Quantum Systems, Max-Planck-Institute for the Physics of Complex Systems, Dresden, October, 2011
- 19) *Quantum Many-body Systems*, Joint Annual Meeting of the Swiss physical society and the Austrian physical society, EPFL Lausanne, June, 2011
- 18) *Local unitary equivalence and entanglement of multipartite pure states*, Workshop on New Trends in Quantum Dynamics and Quantum Entanglement, Trieste, February, 2011
- 17) *Quantum Kolmogorov Complexity*, International Symposium on Quantum Thermodynamics, Stuttgart, Germany, September, 2010
- 16) *Local unitary equivalence of Multipartite Pure States*, Cifar meeting: Quantum Information Processing, Seefeld, Austria, May, 2010

- 15) *Matchgate and space-bounded quantum computations are equivalent: Implications for experiments*, CuQuit meeting, Innsbruck, Austria, January 2010
- 14) *Matchgate and space-bounded quantum computations are equivalent*, ÖPG-SPS annual meeting, Innsbruck, September 2009
- 13) *Local Entanglability and Multipartite Entanglement*, SFB workshop on the "Foundations and Applications of Quantum Science", Innsbruck, Austria, January 2009
- 12) *Quantum State Preparation using dissipation*, WE-Heraeus-Seminar, "New frontiers in Quantum Information Science", Bad Honnef, Germany, November 2008
- 11) *Multipartite entanglement and global information*, QICS workshop on "Foundational Structures for Quantum Information and Computation", Obergurgl, September 2008
- 10) *Quantum Kolmogorov Complexity and its application*, ESF Research Conferences: "Quantum optics; From Photons and atoms to molecules and solid-state systems", Obergurgl, Austria, February 2008
- 09) *Quantenkryptographie*, DPG-Tagung, Osnabrück, Germany, November 2007
- 08) *Quantum Cryptography: security of QKD protocols*, Gordon Research Conference on Quantum Information Science, Il Ciocco, Barga, Italy, May 2006
- 07) *Quantum Kolmogorov Complexity*, MPQ meeting, Ringberg, Germany, April 2006
- 06) *Security of Quantum Key Distribution Protocols*, workshop on Quantum Cryptography, University of Erlangen, Germany, October 2005
- 05) *Quantum Cryptography: Lower and upper bounds on the secret key rate of QKD protocols using one-way classical communication*, MPQ-workshop, Ringberg, Germany, April 2005
- 04) *Quantum Cryptography: Coherent Attacks on the 6-state protocol*, MPQ-workshop, Ringberg, Germany, May 2004
- 03) *Entanglement Properties of Multipartite States*, conference on "Quantum Information: Conceptual Foundations, Developments and Perspectives", Oviedo, Spain, July 2002
- 02) *Entanglement Capability of Two-Qubit Operations*, A3 meeting, Hannover, Germany, February 2001
- 01) *Optimal creation of entanglement using a two-qubit gate*, conference on "Quantum Measurement and Information", Vienna, Austria, December 2000

Contributed Talks

- 09) *Quantum Physics*, Day of Diversity in Physics, Garching, Germany, November 2023
- 08) *"Quantum Algorithms and Applications"*, BMW / TUM - PhD Colloquium on Quantum Computing, Garching, Germany, October 2023
- 07) *Gaining Confidence on the Correct Realization of Arbitrary Quantum Computations*, Quantum Information Workshop 2023, Benasque, Spain, June - July 2023
- 06)

- 05) *Entanglement Theory & verification of quantum devices, kickoff meeting, QCED, Hamburg (online), May 2023*
- Compressed Quantum Simulation of the Ising Model*, 11th International Conference on Quantum Communication, Measurement and Computing (QCMC), Vienna, Austria, July 2012
- 04) *Compressed quantum Computation of the Ising Model*, 9th Central European Quantum Information Processing Workshop (CeQIP), Smolenice, Slovakia, June 2012
- 03) *Entanglement Generation and Hamiltonian Simulation in Continuous-Variable Systems*, DPG Tagung, University of Hannover, March 2003
- 02) *Entangling operations and their implementation using a small amount of entanglement*, Workshop on Quantum Information, Benasque Center for Science, Spain, July 2000
- 01) *Separability of Composite $2 \times N$ Systems*, SFB meeting, Vienna, Austria, December 1999

Seminars and Colloquia

- 50) *Physically relevant multipartite entanglement*, QIT Seminar, Department of Mathematics, TUM, May 2024
- 49) *Rechnen mit Bits und Qubits*. Tag der Physik, Garching, Germany, July 2023
- 48) *Quantum Algorithms & Verification of Quantum Devices*, PhD Colloquium TUM-BMW, Garching, Germany, March 2023
- 47) *Verification of Quantum Devices*, TUM Colloquia "Condensed matter physics", Munich, Germany, June 2022
- 46) *Testing and verifying quantum devices – Theory and experiment (CTP seminar)*, Center for Theoretical Physics of the Polish Academy of Sciences, Warsaw, Poland, January 2022 (online)
- 45) *Quantum Information theory: From Entanglement to Quantum computing*, MCQST-Colloquium, Garching, Germany, November 2021
- 44) *Testing and verifying quantum devices*, IQST Colloquia, Calgary, Canada, June 2021 (online)
- 43) *On the verification of quantum computations and the detection of entanglement*, Optics Division Colloquium, Strathclyde University of Glasgow, UK, May 2021 (online)
- 42) *On verifying quantum computations and the detection of entanglement*, GIQ seminar, Barcelona, Spain, April 2021 (online)
- 41) *On verifying and characterizing quantum devices*, Seminar Geneva, Switzerland, April 2021 (online)
- 40) *Some aspects of quantum advantage*, Innsbruck, May 2020 (online)
- 39) *Recent developments in entanglement theory*, IQOQI, Innsbruck, October 2018

- 38) *A brief introduction to Quantum Computing*, Informatics seminar, Innsbruck, Austria, May 2018
- 37) *Multipartite pure State Transformations*, workshop: Multipartite entanglement, Benasque, Spain, May 2018
- 36) *Compressed Quantum Computation and its Applications*, University of Aarhus, Denmark, January 2018
- 35) *Local transformations and multipartite entanglement measures*, Cambridge, UK, March 2017
- 34) *LOCC transformations among multipartite pure states & entanglement measures*, ETH Zürich, September 2016
- 33) *LOCC transformations among multipartite pure states & entanglement measures*, University of Complutense, Madrid, July, 2016
- 32) *Properties of multipartite entanglement and entanglement measures*, ICFO, Barcelona, Spain, May 2016
- 31) *Multipartite Entanglement in Quantum Information*, San Sebastian, May 2016
- 30) *Multipartite entanglement*, University of Geneva, Switzerland, November 2015
- 29) *Some aspects of multipartite entanglement*, CQT, Singapore, August 2015
- 28) *Maximally entangled sets & operational characterization of few- body entanglement*, University of Pavia Italy, July 2015
- 27) *Certain aspects of entanglement in quantum many-body systems*, MPQ colloquium, Max Planck Institute for Quantum optics, Garching, Germany, January 2015
- 26) *Quantum Metrology using QECC & Maximally Entangled Sets*, University Autònoma, Barcelona, Spain, April 2014
- 25) *Remote entanglement preparation*, University of Pavia, Italy, May 2013
- 24) *Maximally entangled sets*, University of Pavia, Italy, May 2013
- 23) *Dissipative state preparation and decoherence of many-body systems due to many-body interactions*, workshop on Non-Markovian Noise (NOMA2012), Ulm, Germany, October 2012
- 22) *Multipartite entanglement*, SFB-Colloquium, University of Ulm, May, 2011
- 21) *Multipartite entanglement*, Quantum Efficiency Seminar and Colloquium, University of Freiburg, May, 2011
- 20) *Multipartite quantum systems*, Colloquium, chemical physical society, University of Vienna, April 2011

- 19) *Quantum many-body systems*, Max-Planck-Institute for Mathematics in the Sciences, Leipzig, Germany, October, 2010
- 18) *Overview of on-going research projects*, joint group retreat (groups of H. Briegel, W. Dür, and B. Kraus), Maria Waldrast, Sep. 2010, 2011, 2012
- 17) *Local unitary equivalence of multipartite entangled states*, Max-Planck-Institute for Quantum Optics, Garching, Germany, February 2010
- 16) *Matchgate and space-bounded quantum computations are equivalent*, seminar of R. Blatt's research group, January 2010
- 15) *Entanglability and Multipartite Entanglement*, Pavia, Italy, May 2009
- 14) *Many body quantum systems*, ETH Zürich, Switzerland, May 2009
- 13) *Quantum State Preparation and Quantum Phases using dissipation*, Max-Planck-Institute for Quantum Optics, Garching, Germany, March 2008
- 12) *Classical and Quantum Kolmogorov Complexity and its Applications*, University Autònoma, Barcelona, Spain, Feb. 2008
- 11) *Quantum Cryptography, Quantum Kolmogorov Complexity, workshop on Quantum Information*, Benasque, Spain, June 2007
- 10) *Research Results: Division: Prof. H. Briegel*, Quantum Information and computation, Vienna, IQOQI-meeting, March, 2007
- 09) *Quantum Cryptography: security proofs and quantum optical implementations*, Vienna, Austria, April 2006
- 08) *Quantum Cryptography*, University of Basel, October, 2005
- 07) *Quantum Cryptography*, University of Essen, Germany, July 2005
- 06) *Lower and Upper Bounds on the Secret-key Rate for a General Class of Quantum Key Distribution Protocols using one-way classical Communication*, University Complutense Madrid, Spain, May 2005
- 05) *Lower and Upper Bounds on the Secret-key Rate for a General Class of Quantum Key Distribution Protocols using one – way classical Communication*, University of Cambridge, U.K., May 2005
- 04) *Discrete Entanglement Distribution with Squeezed Light*, ETH Zürich, May 2004
- 03) *Generation of Entanglement in Quantum Optical Systems*, University of Geneva, Switzerland, May 2003
- 02) *Separable, Distillable, and Activatable States*, LMU Munich, Germany, May 2002
- 01) *Separable, Distillable, and Activatable States*, California Institute of Technology, USA, March 2002

Others

- 05) *Participant in Panel discussion Quantum Stammtisch, MCQST, Sonthofen, May 2024*
- 04) *Quantum Stammtisch: Quantum Computing: A dream or a reality?* Immanuel Bloch, Ignacio Cirac, Barbara Kraus, Mikhail Lukin, Munich conference on QST, May 2024
- 03) *Quantum Information, Question the Future – Insights into the University of Innsbruck*, Innsbruck, October 2019
- 02) *Heimat großer Wissenschaftlerinnen? Zukunftsperspektiven für Frauen in der Wissenschaft in Österreich*, panel discussion, Austrian Academy of Sciences, Vienna, Austria, March 2019
- 01) *Verschränkung & Anwendungen*, short presentation of research interests, Austrian Academy of Sciences, Vienna, Austria March 2019

Lectures in Summer/Winter Schools

- 10) *Entanglement Theory*, ETN Summer School, Oxford-Abingdon, Great Britain, September 2023
- 09) *Quantum Information Theory*, lecture at the MCQST summer school, Garching, Germany, July 2023
- 08) Invited lecture: *Entanglement theory*, Young Researcher Forum on Quantum Information Science, Hsinchu, Taiwan, (online), August 2020
- 07) *Entanglement theory*, lectures at Summer School "Nanotechnology meets Quantum Information" (NanoQI'19), San Sebastian, Spain, July 2019
- 06) *Quantum Computation*, lectures at 1st VDS Winter School on Quantum Computation, Dienten am Hochkönig, Austria, March 2019
- 05) *Quantum Error Correction*, lecture at Summer School: Introductory Course on Quantum Information, Innsbruck, Austria, July 2018
- 04) *Multipartite Entanglement*, lectures at Advanced School and Workshop on Quantum Science and Quantum Technologies, Trieste, Italy, September 2017
- 03) *Topics in Quantum Information*, lectures at 44th IFF Spring School on Quantum Information Processing, Jülich, Germany, March 2013
- 02) *Quantum Computing: Introductory course on quantum information*, lecture at the summer school, Quantum Information, Innsbruck, July, 2011
- 01) *Quantum Computing*, lecture at the summer school, *Quantum Information and Quantum Gases*, Innsbruck, July 2010

Public Relations

- 06) *Warum sprechen alle von Quantencomputern?*, Vortrag (MCQST/MQV), FORSCHA-Science days Munich, May 2023
- 05) *Wie funktioniert die Verarbeitung von Quanteninformation*, Wissens Durst Festival 2019, Innsbruck, May 2019
- 04) *A new era of quantum mechanics*, ESOF Copenhagen 2014, Copenhagen, Denmark, June 2014
- 03) *Quantum Physics and its Applications* (talk), Night of Science, Innsbruck, April 2012
- 02) *Impact of science and research for Tyrol* (panel discussion), Tyrolean research and science inquiry, Innsbruck, Austria, March 2012
- 01) *Scientific career and participation* (panel discussion), symposium of the Austrian science council, Vienna, Austria, November 2011

Posters

- *Compressed quantum simulation of the XY-model*, QIP, International Conference on Quantum Information Processing and Communication, Barcelona, February 2014
- *Complete operational characterization of three-partite entanglement*, QIPC, International Conference on Quantum Information Processing and Communication, Zürich, Switzerland, September 2011
- *Quantum Simulation of Quantum Computation and Dissipative Processes for State and Phase Preparation*, QIPC, International Conference on Quantum Information Processing and Communication, Rome, Italy, September 2009
- *Quantum State Preparation using dissipation*, Cortina, Italy, February 2009
- *Complexity of States and Evolutions*; and *Quantum Optics and Quantum Information*, SFB-hearing, Vienna, October 2008
- Forschungsthemen der Arbeitsgruppe Briegel: *Quantum Information and Computation*; and *Quanteninformation*; and *Quantum Kolmogorov Complexity and its Applications*, evaluation of the Institute for Quantum Optics and Quantum Information (IQOQI), October 2007
- *Separable, Distillable, and Activatable States*, Eurosc conference: "Quantum Information", San Feliu de Guixols, Spain, March 2002
- *Separability Properties of Three-mode Gaussian States*, Eurosc conference: "Quantum Optics", San Feliu de Guixols, Spain, October 2001
- *Separability Properties of Three-mode Gaussian States*, ESF QIT Programme Conference: "Quantum Information: Theory, Experiments and Perspectives", Gdansk, Poland, July 2001
- *Separability in $2 \times N$ composite quantum systems*, conference: "Complexity, Computation and the Physics of Information", Cambridge, U.K., July 1999

(Co)-Organized Conferences

- 6th Seefeld Workshop on Quantum Information, June 2024
- *Exactly Solved Models and Quantum Computing*, Lorentz Center, Leiden, Netherlands. 18 - 22 March 2024.
Scientific organizers: Kareljan Schoutens, University of Amsterdam, Jerome Dubail,

Université de Lorraine, Jean-Sébastien Caux, University of Amsterdam, Barbara Kraus, Technical University of Munich, German Sierra, Instituto de Fisica Teorica UAM-CSIC

- Workshop: “Quantum Information 2024”, Seefeld, Austria, June 2024. Organizers: W. Dür (Innsbruck), B. Kraus (Technical University of Munich), M. Skotiniotis (University of Granada)
- Workshop: “Quantum Information 2022”, Seefeld, Austria, June 2022. Organizers: W. Dür, J. M. Ramiro, B. Kraus (Innsbruck), M. Skotiniotis (Barcelona, Spain)
- Workshop: “Entanglement in Action”, Benasque, Spain, May 2022. Organizers: G. Gour (Calgary, Canada), B. Kraus (Innsbruck, Austria), J. I. Latorre (Singapore and Abu Dhabi), K. Zyczkowski (Kraków, Poland)
- Workshop: “Quantum Information Theory”, Seefeld, Austria, June 2020 (postponed). Organizers: W. Dür, A. Neven, B. Kraus (Innsbruck), M. Skotiniotis (Barcelona, Spain)
- Workshop: “Entanglement in Action”, Benasque, Spain, May 2020 (postponed). Organizers: G. Gour (Calgary, Canada), B. Kraus (Innsbruck, Austria), J. I. Latorre (Barcelona, Spain), K. Zyczkowski (Kraków, Poland)
- Workshop: “Quantum Information Theory”, Seefeld, Austria, June 2018. Organizers: W. Dür, M. Hebenstreit, B. Kraus (Innsbruck), M. Skotiniotis (Barcelona, Spain)
- Workshop: “Multipartite Entanglement”, Benasque, Spain, May 2018. Organizers: G. Gour (Calgary, Canada), B. Kraus (Innsbruck, Austria), J. I. Latorre (Barcelona, Spain), K. Zyczkowski (Kraków, Poland)
- 3rd Science Day of the young academy of Austria (ÖAW), Innsbruck, 16.2.-17.2. 2017. Organizers: B. Kraus, K. Stöckl, G. Weihs (Innsbruck)
- Workshop: “Quantum Information Theory”, Seefeld, Austria, June 2016. Organizers: W. Dür, B. Kraus, M. Skotiniotis, C. Spee (Innsbruck)
- Workshop: “Multipartite Entanglement”, Benasque, Spain, May 2016. Organizers: G. Gour (Calgary, Canada), B. Kraus (Innsbruck, Austria), J. I. Latorre (Barcelona, Spain), K. Zyczkowski (Kraków, Poland)
- Workshop: “Quantum Information Theory”, Seefeld, Austria, July 2014. Organizers: M. Skotiniotis, W. Dür, B. Kraus (Innsbruck), M. Van den Nest (MPQ Garching)
- Group retreat, Nürnberg, Germany, December 2012
- Conference “Quantum Information meets Statistical Mechanics”, Innsbruck, Austria, September 2012; Organizers: H. J. Briegel (Innsbruck) and M. A. Martin-Delgado (Madrid), local organizers: W. Dür, B. Kraus, M. Tiersch (Innsbruck)
- Workshop: “Quantum Information Theory”, Seefeld, Austria, July 2012. Organizers: J. de Vicente, W. Dür, B. Kraus (Innsbruck), M. Van den Nest (MPQ Garching)
- SFB Workshop: “Foundations and Applications of Quantum Science”, Innsbruck, Austria, February 2011. Organizers: W. Dür (Innsbruck), B. Kraus
- SFB workshop on the *Foundations and Applications of Quantum Science*, Innsbruck, Austria, 29.1.-31.1. 2009. Organizers: M. Arndt (Vienna), J. Hecker Denschlag (Innsbruck), B. Kraus (Innsbruck)
- QICS Workshop on *Foundational Structures for Quantum Information and Computation*, Obergurgl, Austria, 14.9.-20.2. 2008, Organizers: H. J. Briegel (Innsbruck), B. Coecke (Oxford), local organizers: W. Dür, A. Miyake, B. Kraus (Innsbruck)
- QUROPE Winter School on Quantum Information: *Ensemble based Quantum Information Processing*, Obergurgl, Austria, 18.2.-24.2. 2007; Organizers: K. Hammerer, B. Kraus (Innsbruck)

Soft Skills

- *Fundamentals regarding the collective agreement for research group leaders*, University of Innsbruck, November 2010

- *Interesting facts about the administration of third-party funding*, University of Innsbruck, October 2010

Teaching (since 2006)

Summer semester 2024

- Verification and Characterization of Quantum Devices (proseminar 2 h)
- Revision Course to Verification and Characterization of Quantum Devices (repetitorium 2 h)
- Basics of Quantum Computations (proseminar 2 h)
- Exercise to Basics of Quantum Computations (exercise 2 h)
- Quantum Algorithms and Applications (group seminar 2 h)
- Advanced Topics in Entanglement Theory (proseminar 2 h)
- Revision Course to Advanced Topics in Entanglement Theory (repetitorium 2 h)
- Exercise to: VO Quantenphysik (exercise 2 h)
- FOPRA Mastercourse (exercise 2 h)

Winter semester 2023/24

- Exercise to Multipartite Entanglement and its Applications (2 h)
- Verification and Characterization of Quantum Devices (proseminar 2 h)
- Multipartite Entanglement and its Applications (lecture 4h + exercise 2h)
- Large Exercise to Multipartite Entanglement and its Applications (2 h)
- Questions and Answers to Multipartite Entanglement and its Applications (exercise 2h)
- Condensed Matter Theory Seminar (2 h)
- Condensed Matter Theory Journal Club (2 h)
- Basics of Quantum Computations (2 h)
- Entanglement in Many-Body System (2 h)

Summer semester 2023

- Advanced Topics in Quantum Information Theory (lecture + exercise 2h + 2h exercise)
- Introduction to Quantum Information Theory (lecture 2 h)
- Mentoring in the Bachelor's Program Physics (colloquium 2 h)
- Revision Course to Entanglement and Correlations in Multipartite Systems (revision 2h)
- Entanglement and Correlations in Multipartite Systems (proseminar 2h)
- Basics of Quantum Computations (2 h)
- Condensed Matter Theory Journal Club (2 h)
- Condensed Matter Theory Seminar (2 h)
- Entanglement in Many-Body System (2 h)
-

Winter semester 2022/23

- Research seminar: Entanglement and its applications (seminar 2h)
- Mathematical Methods in Physics III (lecture 3h)
- Modern Developments in Theoretical Physics (seminar 2h, together with other faculty members)
- Literature seminar: Quantum Information (seminar 2h, together with other faculty members)

Summer semester 2022

- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

- Literature seminar: Quantum Information (seminar 2h, together with other faculty members)
- Research seminar: Entanglement and its applications (seminar 2h, online)

Winter semester 2021/22

- Research seminar: Entanglement and its applications (seminar 2h, online)
- Mathematical Methods in Physics III (lecture 3h, online)
- Quantum Information Theory (lecture 3h, online)
- Literature seminar: Quantum Information (seminar 2h, together with other faculty members)

Summer semester 2021

- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)
- Literature seminar: Quantum Information (seminar 2h, together with other faculty members)
- Research seminar: Entanglement and its applications (seminar 2h, online)

Winter semester 2020/21

- Research seminar: Entanglement and its applications (seminar 2h, online)
- Mathematical Methods in Physics III (lecture 3h, online)
- Quantum Information Theory (lecture 3h, online)
- Literature seminar: Quantum Information (seminar 2h, together with other faculty members)

Summer semester 2020

- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)
- Literature seminar: Quantum Information (seminar 2h, together with other faculty members, online)
- Research seminar: Methods and Concepts of Quantum Information (seminar 2h, online)

Winter semester 2019/20

- Mathematical Methods in Physics II (lecture 3h)
- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Tools for the Study of Multipartite Correlations (lecture & exercise 2h)
- Literature seminar: Quantum Information (seminar 2h, together with W. Dür)

Summer semester 2019

- Methods and concepts in Quantum Information (lecture 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Institute seminar: New developments in theoretical physics (seminar 1h) (together with H. Ritsch)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2018/19

- Mathematical Methods in Physics II (lecture 3h)
- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Mathematical Tools for the Study of Multipartite Correlations (course 2h)
- Literature seminar: Quantum Information (seminar 2h)
- Institute seminar: New developments in theoretical physics (seminar 1h) (together with H. Ritsch)

Summer semester 2018

- Methods and concepts in Quantum Information (course 3h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Institute seminar: New developments in theoretical physics (seminar 1h) (together with H. Ritsch)

- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2017/18

- Mathematical Methods in Physics II (lecture 3h)
- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Mathematical Tools for the Study of Multipartite Correlations (course 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)

Summer semester 2017

- Quantum Information and Simulation (course 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2016/17

- Quantum information theory (lecture 2h)
- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Basic Concepts in Quantum Physics (lecture 3h) (together with H. Ch. Nägerl)
- Mathematical Tools for the Study of Multipartite Correlations (course 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Entanglement in Condensed Matter (course 3h) (together with A. Läuchli)
- Gender relevant aspects in Mathematics, Physics, and Informatics (course 2h)

Summer semester 2016

- Methods and concepts in Quantum Information (course 4h) (together with H. Briegel)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2015/16

- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Basic Concepts in Quantum Physics (lecture 3h) (together with H. Ch. Nägerl)
- Basic course on Mathematics (exercises 1h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Entanglement in Condensed Matter (course 3h) (together with A. Läuchli)
- Gender relevant aspects in Mathematics, Physics, and Informatics (course 2h)

Summer semester 2015

- Methods and concepts in Quantum Information (course 4h) (together with H. Briegel, W. Dür)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2014/15

- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Basic Concepts in Quantum Physics (lecture 3h together with H. Ch. Nägerl)
- Basic course on Mathematics (exercises 2 x 1h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)

Summer semester 2014

- Entanglement Theory (course 2h)
- Literature seminar Quantum Information (seminar 2h) (together with W. Dür)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2013/14

- Mathematical Methods in Physics III (lecture 2h)
- Mathematical Methods in Physics III (exercises 1h)
- Quantum information theory (lecture 2h)
- Quantum information theory (exercises 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)

Summer semester 2013

- Multipartite Entangled States (lecture and exercises 3h, together with W. Dür)
- Literature seminar Quantum Information (seminar 2h) (together with W. Dür)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2012/13

- Mathematical Methods in Physics III (lecture 2h)
- Equal opportunity and gender studies (seminar 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)

Summer semester 2012

- Bachelor seminar (seminar 2h)
- Literature seminar Quantum Information (seminar 2h) (together with W. Dür)
- Theoretical Physics 2 (exercises 2h)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2011/12

- Quantum information theory (lecture 2h)
- Quantum information theory (exercises 2h)
- Literature seminar: Quantum Information (seminar 2h) (together with W. Dür)

Summer semester 2011

- Theoretical Physics 2 (exercises 4h)
- Seminar with Bachelor's Thesis (seminar 2h) (together with all faculty members)

Winter semester 2009/2010

- Quantum Information Theory (lecture 2 h)

Winter semester 2007/2008

- Classical and Quantum Cryptography (lecture 1 h)
- Mathematical Methods of Physics III (lecture 2h)

Summer semester 2007

- Quantum Optics in collaboration with Dr. K. Hammerer (lecture 2 h)

List of Publications

Publications (peer-review): 77; Proceedings: 7; Preprints: 4

According to Google Scholar:

Citations (all): 10042

h-index (all): 40

i10-index (all): 64

Publications (peer-review)

- 77) Spee, Cornelia; Kraft, Tristan: Transformations in quantum networks via local operations assisted by finitely many rounds of classical communication. *Quantum* 2024-03 **8**, 2024, 1286 [more...](#) [BibTeX](#) [Full text \(DOI \)](#)
- 76) Stricker, Roman; Carrasco, Jose; Ringbauer, Martin; Postler, Lukas; Meth, Michael; Edmunds, Claire; Schindler, Philipp; Blatt, Rainer; Zoller, Peter; Kraus, Barbara; Monz, Thomas: Towards experimental classical verification of quantum computation. *Quantum Science and Technology* 2024-02 **9** (2), 2024, 02LT01 [mehr...](#) [BibTeX](#) [Volltext \(DOI \)](#)
- 75) Li, NKH; Spee, C; Hebenstreit, M; de Vicente, JI; Kraus, B, *Identifying families out of multipartite states with non-trivial local entanglement transformations*, *Quantum* 8, 1270 (2024) doi.org/10.22331/q-2024-02-29-1270
- 74) Carrasco, Jose; Votto, Matteo; Vitale, Vittorio; Kokail, Christian; Neven, Antoine; Zoller, Peter; Vermersch, Benoît; Kraus, Barbara: Entanglement phase diagrams from partial transpose moments. *Physical Review A* 2024-01 **109** (1), 2024 [more...](#) [BibTeX](#) [Full text \(DOI \)](#)
- 73) Englbrecht, Matthias; Kraft, Tristan; Dittel, Christoph; Buchleitner, Andreas; Giedke, Geza; Kraus, Barbara: Indistinguishability of Identical Bosons from a Quantum Information Theory Perspective. *Phys. Rev. Lett.* 132, 050201 2024-01 **132** (5), 2024 [more...](#) [BibTeX](#) [Full text \(DOI \)](#)
- 72) Gunn, D; Hebenstreit, M; Spee, C.; de Vicente, J.I.; Kraus, B, Approximate and ensemble local entanglement transformations for multipartite states, *Phys. Rev. A* **108**, 052401 (2023). DOI: [10.1103/PhysRevA.108.052401](https://doi.org/10.1103/PhysRevA.108.052401)
- 71) M. Englbrecht, T. Kraft, B. Kraus, *Transformations of Stabilizer States in Quantum Networks*, *Quantum* **6**, 846 (2022). DOI: [10.22331/q-2022-10-25-846](https://doi.org/10.22331/q-2022-10-25-846)
- 70) D. González-Cuadra, T. V. Zache, J. Carrasco, B. Kraus, P. Zoller, *Hardware efficient quantum simulation of non-abelian gauge theories with qudits on Rydberg platforms*, *Phys. Rev. Lett.* **129**, 160501 (2022). DOI: [10.1103/PhysRevLett.129.160501](https://doi.org/10.1103/PhysRevLett.129.160501)
- 69) M. Hebenstreit, C. Spee, N. K. H. Li, B. Kraus, J. I. de Vicente, *State transformations within entanglement classes containing permutation-symmetric states*, *Phys. Rev. A* **105**, 032458 (2022). DOI: [10.1103/PhysRevA.105.032458](https://doi.org/10.1103/PhysRevA.105.032458)
- 68) V. Vitale, A. Elben, R. Kueng, A. Neven, J. Carrasco, B. Kraus, P. Zoller, P. Calabrese, B. Vermersch, M. Dalmonte, *Symmetry-resolved dynamical purification in synthetic quantum matter*, *SciPost Phys.* **12**, 106 (2022). DOI: [10.21468/SciPostPhys.12.3.106](https://doi.org/10.21468/SciPostPhys.12.3.106)
- 67) M. Hebenstreit, D. Sauerwein, A. Molnar, J. I. Cirac, B. Kraus, *Symmetries and local transformations of translationally invariant matrix product states*, *Phys. Rev. A* **105**, 032424 (2022). DOI: [10.1103/PhysRevA.105.032424](https://doi.org/10.1103/PhysRevA.105.032424)
- 66) A. Neven, J. Carrasco, V. Vitale, C. Kokail, A. Elben, M. Dalmonte, P. Calabrese, P. Zoller, B. Vermersch, R. Kueng, B. Kraus, *Symmetry-resolved entanglement detection using partial transpose moments*, *npj Quantum Information* **7**, Article number: 152 (2021). DOI: [10.1038/s41534-021-00487-y](https://doi.org/10.1038/s41534-021-00487-y)

- 65) A. Neven, D. Gunn, M. Hebenstreit, B. Kraus, *Local transformations of multiple multipartite states*, SciPost Phys. **11**, 042 (2021). DOI: [10.21468/SciPostPhys.11.2.042](https://doi.org/10.21468/SciPostPhys.11.2.042)
- 64) J. Carrasco, A. Elben, C. Kokail, B. Kraus, P. Zoller, *Theoretical and Experimental Perspectives of Quantum Verification*, PRX Quantum **2**, 010102 (2021). DOI: [10.1103/PRXQuantum.2.010102](https://doi.org/10.1103/PRXQuantum.2.010102)
- 63) M. Hebenstreit, M. Englbrecht, C. Spee, J. I. de Vicente, B. Kraus, *Measurement outcomes that do not occur and their role in entanglement transformations*, New J. Phys. **23**, 033046 (2021). DOI: [10.1088/1367-2630/abe60c](https://doi.org/10.1088/1367-2630/abe60c)
- 62) A. Elben, R. Kueng, H. Hsin-Yuan, R. van Bijnen, C. Kokail, M. Dalmonte, P. Calabrese, B. Kraus, J. Preskill, P. Zoller, B. Vermersch, *Mixed-state entanglement from local randomized measurements*, Phys. Rev. Lett. **125**, 200501 (2020). DOI: [10.1103/PhysRevLett.125.200501](https://doi.org/10.1103/PhysRevLett.125.200501)
- 61) M. Hebenstreit, R. Jozsa, B. Kraus, S. Strelchuk, *Computational power of matchgates with supplementary resources*, Phys. Rev. A **102**, 052604 (2020), Editor's Suggestion. DOI: [10.1103/PhysRevA.102.052604](https://doi.org/10.1103/PhysRevA.102.052604)
- 60) O. Slowik, M. Hebenstreit, B. Kraus, A. Sawicki, *A link between symmetries of critical states and the structure of SLOCC classes in multipartite systems*, Quantum **4**, 300 (2020). DOI: [2020-07-20-300](https://doi.org/10.26434/chemrxiv-2020-07-20-300)
- 59) M. Englbrecht, B. Kraus, *Symmetries and entanglement of stabilizer states*, Phys. Rev. A **101**, 062302 (2020). DOI: [10.1103/PhysRevA.101.062302](https://doi.org/10.1103/PhysRevA.101.062302)
- 58) D. Sauerwein, A. Molnar, J. I. Cirac, B. Kraus, *Matrix Product States: Entanglement, symmetries, and state transformations*, Phys. Rev. Lett. **123**, 170504 (2019). DOI: [10.1103/PhysRevLett.123.170504](https://doi.org/10.1103/PhysRevLett.123.170504)
- 57) M. Hebenstreit, R. Jozsa, B. Kraus, S. Strelchuk, M. Yoganathan, *All pure fermionic non-Gaussian states are magic states for matchgate computations*, Phys. Rev. Lett. **123**, 080503 (2019). DOI: [10.1103/PhysRevLett.123.080503](https://doi.org/10.1103/PhysRevLett.123.080503)
- 56) H. Yamasaki, A. Pirker, M. Murao, W. Dür, B. Kraus, *Multipartite entanglement outperforms bipartite entanglement under limited quantum system sizes*, Phys. Rev. A **98**, 052313 (2018). DOI: [10.1103/PhysRevA.98.052313](https://doi.org/10.1103/PhysRevA.98.052313)
- 55) D. Sauerwein, N. R. Wallach, G. Gour, B. Kraus, *Transformations among pure multipartite entangled states via local operations are almost never possible*, Phys. Rev. X **8**, 031020 (2018). DOI: [10.1103/PhysRevX.8.031020](https://doi.org/10.1103/PhysRevX.8.031020)
- 54) C. Spee, K. Schwaiger, G. Giedke, B. Kraus, *Mode-entanglement of Gaussian fermionic states*, Phys. Rev. A **97**, 042325 (2018). DOI: [10.1103/PhysRevA.97.042325](https://doi.org/10.1103/PhysRevA.97.042325)
- 53) M. Hebenstreit, M. Gachechiladze, O. Gühne, B. Kraus, *Coarse graining of entanglement classes in $2 \times m \times n$ Systems*, Phys. Rev. A **97**, 032330 (2018). DOI: [10.1103/PhysRevA.97.032330](https://doi.org/10.1103/PhysRevA.97.032330)
- 52) K. Schwaiger, B. Kraus, *Relations between bipartite entanglement measures*, Quantum Information and Computation, **18**, No. 1&2 0085–0113 (2018). DOI: [10.26421/QIC18.1-2](https://doi.org/10.26421/QIC18.1-2)
- 51) G. Gour, B. Kraus, N. R. Wallach, *Almost all multipartite qubit quantum states have trivial stabilizer*, J. Math. Phys. **58**, 092204 (2017). DOI: [10.1063/1.5003015](https://doi.org/10.1063/1.5003015)
- 50) M. Hebenstreit, D. Alsina, J. I. Latorre, B. Kraus, *Compressed quantum computation using a remote five-qubit quantum computer*, Phys. Rev. A **95**, 052339 (2017). DOI: [10.1103/PhysRevA.95.052339](https://doi.org/10.1103/PhysRevA.95.052339)

- 49) D. Sauerwein, Ch. Macchiavello, L. Maccone, B. Kraus, *Multipartite correlations in mutually unbiased bases*, Phys. Rev. A **95**, 042315 (2017). DOI: [10.1103/PhysRevA.95.042315](https://doi.org/10.1103/PhysRevA.95.042315)
- 48) M. Hebenstreit, B. Kraus, L. Ostermann, H. Ritsch, *Subradiance and entanglement in atoms with several independent decay channels*, Phys. Rev. Lett. **118**, 143602 (2017). DOI: [10.1103/PhysRevLett.118.143602](https://doi.org/10.1103/PhysRevLett.118.143602)
- 47) C. Spee, J. I. de Vicente, D. Sauerwein, B. Kraus, *Entangled Pure State Transformations via Local Operations Assisted by Finitely Many Rounds of Classical Communication*, Phys. Rev. Lett. **118**, 040503 (2017). DOI: [10.1103/PhysRevLett.118.040503](https://doi.org/10.1103/PhysRevLett.118.040503)
- 46) J.I. de Vicente, C. Spee, D. Sauerwein, B. Kraus, *Entanglement manipulation of multipartite pure states with finite rounds of classical communication*, Phys. Rev. A **95**, 012323 (2017). DOI: [10.1103/PhysRevA.95.012323](https://doi.org/10.1103/PhysRevA.95.012323)
- 45) W. L. Boyajian, M. Skotiniotis, W. Dür, B. Kraus, *Compressed quantum metrology for the Ising Hamiltonian*, Phys. Rev. A **94**, 062326 (2016). DOI: [10.1103/PhysRevA.94.062326](https://doi.org/10.1103/PhysRevA.94.062326)
- 44) M. Hebenstreit, C. Spee, B. Kraus, *The MES of tripartite qutrit states and pure state separable transformations which are not possible via LOCC*, Phys. Rev. A **93**, 012339 (2016), Editor suggestion. DOI: [10.1103/PhysRevA.93.012339](https://doi.org/10.1103/PhysRevA.93.012339)
- 43) C. Spee, J. I. de Vicente, B. Kraus, *The maximally entangled set for 4-qubit states*, J. Math. Phys. **57**, 052201 (2016). DOI: [10.1063/1.4946895](https://doi.org/10.1063/1.4946895)
- 42) D. Sauerwein, K. Schwaiger, M. Cuquet, J.I. de Vicente, B. Kraus, *The source and accessible entanglement of few-body systems*, Phys. Rev. A **92**, 062340 (2015). DOI: [10.1103/PhysRevA.92.062340](https://doi.org/10.1103/PhysRevA.92.062340)
- 41) K. Schwaiger, D. Sauerwein, M. Cuquet, J.I. de Vicente, B. Kraus, *Operational multipartite entanglement measures*, Phys. Rev. Lett. **115**, 150502 (2015). DOI: [10.1103/PhysRevLett.115.150502](https://doi.org/10.1103/PhysRevLett.115.150502)
- 40) W. L. Boyajian, B. Kraus, *Compressed simulation of thermal and excited states of the 1-D XY-model*, Phys. Rev. A **92**, 032323 (2015). DOI: [10.1103/PhysRevA.92.032323](https://doi.org/10.1103/PhysRevA.92.032323)
- 39) Michalis Skotiniotis, Florian Fröwis, Wolfgang Dür, Barbara Kraus, *Algebraic metrology: Pretty good states and bounds*, Phys. Rev. A **92**, 022323 (2015). DOI: [10.1103/PhysRevA.92.022323](https://doi.org/10.1103/PhysRevA.92.022323)
- 38) F. Fröwis, M. Skotiniotis, B. Kraus, W. Dür, *Optimal quantum states for frequency estimation*, New J. Phys. **16**, 083010 (2014). DOI: [10.1088/1367-2630/16/8/083010/meta](https://doi.org/10.1088/1367-2630/16/8/083010/meta)
- 37) O. Gühne, M. Cuquet, F.E.S. Steinhoff, T. Moroder, M. Rossi, D. Bruß, B. Kraus, C. Macchiavello, *Entanglement and nonclassical properties of hypergraph states*, J. Phys. A: Math. Theor. **47**, 335303 (2014). DOI: [10.1088/1751-8113/47/33/335303/meta](https://doi.org/10.1088/1751-8113/47/33/335303/meta)
- 36) W. Dür, M. Skotiniotis, F. Fröwis, B. Kraus, *Improved quantum metrology using quantum error-correction*, Phys. Rev. Lett. **112**, 080801 (2014). DOI: [10.1103/PhysRevLett.112.080801](https://doi.org/10.1103/PhysRevLett.112.080801)
- 35) G. Giedke, B. Kraus, *Gaussian local unitary equivalence of n-mode Gaussian states and Gaussian transformations by local operations with classical communication*, Phys. Rev. A **89**, 012335 (2014). DOI: [10.1103/PhysRevA.89.012335](https://doi.org/10.1103/PhysRevA.89.012335)

- 34) W. Boyajian, V. Murg, B. Kraus, *Compressed Simulation of evolutions of the XY-model*, Phys. Rev. A **88**, 052329 (2013). DOI: [10.1103/PhysRevA.88.052329](https://doi.org/10.1103/PhysRevA.88.052329)
- 33) Ch. Spengler, B. Kraus, *A graph state formalism for mutually unbiased bases*, Phys. Rev. A **88**, 052323 (2013). DOI: [10.1103/PhysRevA.88.052323](https://doi.org/10.1103/PhysRevA.88.052323)
- 32) J. de Vicente, C. Spee, B. Kraus, *Maximally entangled sets of multipartite states*, Phys. Rev. Lett. **111**, 110502 (2013). DOI: [10.1103/PhysRevLett.111.110502](https://doi.org/10.1103/PhysRevLett.111.110502)
- 31) C. Spee, J. de Vicente, B. Kraus, *Remote entanglement preparation*, Phys. Rev. A **88**, 010305(R) (2013). DOI: [10.1103/PhysRevA.88.010305](https://doi.org/10.1103/PhysRevA.88.010305)
- 30) M. Skotiniotis, W. Dür, B. Kraus, *Efficient quantum communication under collective noise*, Quantum Information and Computation, **13**, 3, 0290-0323 (2013). [arXiv:1204.0891](https://arxiv.org/abs/1204.0891)
- 29) T. Carle, B. Kraus, W. Dür, J. I. de Vicente, *Purification to Locally Maximally Entangleable States*, Phys. Rev. A **87**, 012328 (2013). DOI: [10.1103/PhysRevA.87.012328](https://doi.org/10.1103/PhysRevA.87.012328)
- 28) J. I. de Vicente, T. Carle, C. Streitberger, B. Kraus, *Complete set of operational measures for the characterization of 3-qubit entanglement*, Phys. Rev. Lett. **108**, 041805 (2012). DOI: [10.1103/PhysRevLett.108.060501](https://doi.org/10.1103/PhysRevLett.108.060501)
- 27) B. Kraus, *Compressed quantum simulation of the Ising model*, Phys. Rev. Lett. **107**, 250503 (2011). DOI: [10.1103/PhysRevLett.107.250503](https://doi.org/10.1103/PhysRevLett.107.250503)
- 26) T. Carle, H. J. Briegel, B. Kraus, *Decoherence of many-body systems due to many-body interactions*, Phys. Rev. A **84**, 012105 (2011). DOI: [10.1103/PhysRevA.84.012105](https://doi.org/10.1103/PhysRevA.84.012105)
- 25) B. Kraus, *Local unitary equivalence and entanglement of multipartite pure states* Phys. Rev. A **82**, 032121 (2010). DOI: [10.1103/PhysRevA.82.032121](https://doi.org/10.1103/PhysRevA.82.032121)
- 24) B. Kraus, *Local unitary equivalence of multipartite pure states*, Phys. Rev. Lett. **104**, 020504 (2010). DOI: [10.1103/PhysRevLett.104.020504](https://doi.org/10.1103/PhysRevLett.104.020504)
- 23) R. Jozsa, B. Kraus, A. Miyake, J. Watrous, *Matchgate and space-bounded quantum computations are equivalent*, Proc. R. Soc. A **466**, 809 (2010). DOI: [10.1098/rspa.2009.0433](https://doi.org/10.1098/rspa.2009.0433)
- 22) C. Kruszynska and B. Kraus, *Local entanglability and multipartite entanglement*, Phys. Rev. A, **79**, 052304 (2009). DOI: [10.1103/PhysRevA.79.052304](https://doi.org/10.1103/PhysRevA.79.052304)
- 21) S. Diehl, A. Micheli, A. Kantian, B. Kraus, H.P. Büchler, P. Zoller, *Quantum States and Phases in Driven Open Quantum Systems with Cold Atoms*, Nature Physics **4**, 878 (2008). DOI: [10.1038/nphys1073](https://doi.org/10.1038/nphys1073)
- 20) B. Kraus, H. P. Büchler, S. Diehl, A. Kantian, A. Micheli, P. Zoller, *Preparation of Entangled States by Quantum Markov Processes*, Phys. Rev. A **78**, 042307 (2008). DOI: [10.1103/PhysRevA.78.042307](https://doi.org/10.1103/PhysRevA.78.042307)
- 19) C. Mora, H. Briegel, B. Kraus, *Quantum Kolmogorov complexity and its applications*, Int. J. Quant. Inf. **5**, 729 (2007). DOI: [10.1142/S0219749907003171](https://doi.org/10.1142/S0219749907003171)
- 18) B. Kraus, C. Branciard, R. Renner, *Security of quantum key distribution protocols using two-way classical communication or weak coherent pulses*, Phys. Rev. A **75**, 012316 (2007). DOI: [10.1103/PhysRevA.75.012316](https://doi.org/10.1103/PhysRevA.75.012316)
- 17) L. Hartmann, B. Kraus, H.-J. Briegel, W. Dür, *Role of memory errors in quantum repeaters*, Phys. Rev. A **75**, 032310 (2007). DOI: [10.1103/PhysRevA.75.032310](https://doi.org/10.1103/PhysRevA.75.032310)

- 16) N. Gisin, S. Fasel, B. Kraus, H. Zbinden, and G. Ribordy, *Trojan Horse Attacks on Quantum Key Distribution Systems*, Phys. Rev. A **73**, 022320 (2006). DOI: [10.1103/PhysRevA.73.022320](https://doi.org/10.1103/PhysRevA.73.022320)
- 15) B. Kraus, W. Tittel, N. Gisin, M. Nilsson, S. Kröll, J. I. Cirac, *Quantum memory for non-stationary light fields based on controlled reversible inhomogeneous broadening*, Phys. Rev. A **73**, 020302 (2006). DOI: [10.1103/PhysRevA.73.020302](https://doi.org/10.1103/PhysRevA.73.020302)
- 14) B. Kraus, N. Gisin, and R. Renner, *Lower and Upper Bounds on the Secret-Key Rate for Quantum Key Distribution Protocols Using One-Way Classical Communication*, Phys. Rev. Lett. **95**, p. 080501 (2005). DOI: [10.1103/PhysRevLett.95.080501](https://doi.org/10.1103/PhysRevLett.95.080501)
- 13) C. Branciard, N. Gisin, B. Kraus, and V. Scarani, *Security of two quantum cryptography protocols using the same four qubit states*, Phys. Rev. A **72**, p. 032301 (2005). DOI: [10.1103/PhysRevA.72.032301](https://doi.org/10.1103/PhysRevA.72.032301)
- 12) R. Renner, N. Gisin, and B. Kraus, *Information-theoretic security proof for quantum-key-distribution protocols*, Phys. Rev. A **72**, p. 012332 (2005). DOI: [10.1103/PhysRevA.72.012332](https://doi.org/10.1103/PhysRevA.72.012332)
- 11) B. Kraus and J. I. Cirac, *Discrete Entanglement Distribution with Squeezed Light*, Phys. Rev. Lett. **92**, p. 13602 (2004). DOI: [10.1103/PhysRevLett.92.013602](https://doi.org/10.1103/PhysRevLett.92.013602)
- 10) B. Kraus, K. Hammerer, G. Giedke, and J. I. Cirac, *Entanglement generation and Hamiltonian simulation in continuous-variable systems*, Phys. Rev. A **67**, p. 042314 (2003). DOI: [10.1103/PhysRevA.67.042314](https://doi.org/10.1103/PhysRevA.67.042314)
- 09) B. Kraus, M. Lewenstein, and J. I. Cirac, *Characterization of Distillable and Activatable States using Entanglement Witnesses*, Phys. Rev. A **65**, p. 042327 (2002). DOI: [10.1103/PhysRevA.65.042327](https://doi.org/10.1103/PhysRevA.65.042327)
- 08) G. Giedke, B. Kraus, M. Lewenstein, and J. I. Cirac, *Entanglement Criteria for All Bipartite Gaussian States*, Phys. Rev. Lett. **87**, p. 167904 (2001). DOI: [10.1103/PhysRevLett.87.167904](https://doi.org/10.1103/PhysRevLett.87.167904)
- 07) G. Giedke, B. Kraus, M. Lewenstein, and J. I. Cirac, *Separability Properties of Three-mode Gaussian States*, Phys. Rev. A **64**, p. 052303 (2001). DOI: [10.1103/PhysRevA.64.052303](https://doi.org/10.1103/PhysRevA.64.052303)
- 06) B. Kraus and J. I. Cirac, *Optimal Creation of Entanglement Using a Two-qubit Gate*, Phys. Rev. A **63**, p.062309 (2001). DOI: [10.1103/PhysRevA.63.062309](https://doi.org/10.1103/PhysRevA.63.062309)
- 05) J. I. Cirac, W. Dür, B. Kraus, and M. Lewenstein, *Entangling Operations and Their Implementation Using a Small Amount of Entanglement*, Phys. Rev. Lett. **86**, p. 544 (2001). DOI: [10.1103/PhysRevLett.86.544](https://doi.org/10.1103/PhysRevLett.86.544)
- 04) M. Lewenstein, B. Kraus, P. Horodecki, and J. I. Cirac, *Characterization of Separable States and Entanglement Witnesses*, Phys. Rev. A **63**, p. 044304 (2001). DOI: [10.1103/PhysRevA.63.044304](https://doi.org/10.1103/PhysRevA.63.044304)
- 03) M. Lewenstein, D. Bruss, J. I. Cirac, B. Kraus, M. Küs, J. Samsonowicz, A. Sanpera, and R. Tarrach, *Separability and Distillability in Composite Quantum Systems -a Primer-*, J. Mod. Opt. **47**, p. 2481 (2000). DOI: [10.1080/09500340008232176](https://doi.org/10.1080/09500340008232176)
- 02) M. Lewenstein, B. Kraus, J. I. Cirac, and P. Horodecki, *Optimization of Entanglement Witnesses*, Phys. Rev. A **62**, p. 052310 (2000). DOI: [10.1103/PhysRevA.62.052310](https://doi.org/10.1103/PhysRevA.62.052310)
- 01) B. Kraus, J. I. Cirac, S. Karnas, and M. Lewenstein, *Separability in 2xN Composite Quantum Systems*, Phys. Rev. A **61**, p. 062302 (2000). DOI: [10.1103/PhysRevA.61.062302](https://doi.org/10.1103/PhysRevA.61.062302)

Proceedings

- 07) C. Spee, J. I. de Vicente, B. Kraus, *Few-body entanglement manipulation*. Quantum [Un]Speakables II, edited by R. Bertlmann and A. Zeilinger (Springer, 2017), pp. 365-380; arXiv:quant-ph/1504.02643 (2015)
- 06) B. Kraus, *Compressed quantum simulations*, AIP proceedings **1633**, 131, Eleventh International Conference on Quantum Communication, Measurement and Computation, (QCMC 2012), edited by H. J. Schmiedmayer, Ph. Walther
- 05) B. Kraus, G. Giedke, M. Lewenstein, and J. I. Cirac, *Entanglement Properties of Gaussian States*, Fort. Phys. **51** (4-5), p. 305 (2003)
- 04) D. Bruss, J. I. Cirac, P. Horodecki, F. Hulpke, B. Kraus, M. Lewenstein, and A. Sanpera, *Reflections upon Separability and Distillability*, J. Mod. Opt. **49**, p. 1399-1418 (2002)
- 03) B. Kraus, W. Dür, G. Vidal, J. I. Cirac, M. Lewenstein, N. Linden, and S. Popescu, *Entanglement Capability of Two-qubit Operations*, Z. Naturforsch. **56 a**, p. 91 (2001)
- 02) G. Giedke, B. Kraus, L.-M. Duan, P. Zoller, M. Lewenstein, and J. I. Cirac, *Separability and Distillability of Gaussian states - the Complete Story*, Fort. Phys. **49**, p. 973 (2001)
- 01) B. Kraus, P. Törmä, *Transition phenomena in networks of quantum systems*, Quantum Communication, Computing, and Measurement **2**, p. 347 (2000)

Preprints

- 04) T Olsacher, T Kraft, C Kokail, B Kraus, P Zoller. [Hamiltonian and Liouvillian learning in weakly-dissipative quantum many-body systems](#). arXiv preprint arXiv:2405.06768
- 03) J Carrasco, M Langer, A Neven, B Kraus: [Gaining confidence on the correct realization of arbitrary quantum computations](#). arXiv preprint arXiv:2308.11368 (2023).
- 02) Gunn, D; Styliaris, G; Kraft, T; Kraus, B, [Phases of Matrix Product States with Symmetric Quantum Circuits and Symmetric Measurements with Feedforward](#), arXiv preprint arXiv:2312.13838 (2023)
- 01) Sauerwein, D; Schwaiger, K; Kraus, B. [Discrete And Differentiable Entanglement Transformations](#). arXiv:1808.02819 [quant-ph] (2018).