

Curriculum vitae

Katarzyna **Roszak**

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Education and degrees

- 2016** Habilitation in Physics,
Department of Theoretical Physics, Wrocław University of Science and Technology
- 2008** PhD in Theoretical Physics,
Institute of Physics, Wrocław University of Technology
- 2004** MSc in Physics,
Faculty of Fundamental Problems of Technology, Wrocław University of Technology

Employment

- 2004-2008** PhD student at the Institute of Physics, Wrocław University of Technology
- 2006-2007** DAAD research scholarship at the Münster University (in the group of prof. T. Kuhn)
- 2008-2010** research assistant at the Institute of Physics, Wrocław University of Technology
- 2009-2010** postdoctoral position at the Faculty of Mathematics and Physics,
Charles University in Prague (in the group of dr T. Novotný)
- 2010-2014** specialist position at the Institute of Physics, Wrocław University of Technology
- 2014** postdoctoral position at the Faculty of Mathematics and Physics,
Charles University in Prague (June-September, in the group of dr T. Novotný)
- 2014-2019** adiunkt (assistant professor) at the Department of Theoretical Physics,
Wrocław University of Science and Technology
- 2017-2018** postdoctoral position at the Institute of Physics,
Czech Academy of Sciences (June-February, in the group of dr K. Netočný)
- 2018** postdoctoral position at the Institute of Physics,
Czech Academy of Sciences (November, in the group of dr K. Netočný)
- 2019** postdoctoral position at the Department of Optics and Quantum Optics Laboratory,
Palacký University Olomouc (November, in the group of prof. R. Filip)
- 2019-2022** professor at the Department of Theoretical Physics,
Wrocław University of Science and Technology
- 2021-2022** postdoctoral position at the Department of Optics and Quantum Optics Laboratory,
Palacký University Olomouc (October-February, in the group of prof. R. Filip)
- 2022-now** reseracher at the Department of Condensed Matter Theory, Institute of Physics,
Czech Academy of Sciences (from March)

Bibliometric data (10.10.2022) according to Web of Science

No. of publications: **46**

No. of citations: **487** (**344** without self-citations)

Hirsch index: **13**

Bibliometric data (10.10.2022) according to Google Scholar

No. of citations: **722**

Hirsch index: **16**

Since 2017

No. of citations: **360**

Hirsch index: **11**

Research Interests

Solid state qubits

System-environment entanglement

Open quantum systems

Quantum vs. classical decoherence

Quantum dots

Quantum transport

Quantum correlations

Awards

2006 DAAD Scholarship for Young Scientists

2009 Award of the Prime Minister of the PhD Thesis

2009 Award of the Rektor of the Wrocław University of Science and Technology

2011 START Scholarship of the Foundation for Polish Science

2012 Lindau Nobel Laureate Meeting Participant (via the Foundation For Polish Science)

2016 Award of the Rektor of the Wrocław University of Science and Technology

2017 Award of the Rektor of the Wrocław University of Science and Technology

Collaboration

1. prof. Jan Sperling, Paderborn University, Germany
2. dr hab. Jarosław Pawłowski, Wrocław University of Science and Technology, Poland
3. prof. John Goold, Trinity College Dublin, Ireland
4. dr Diogo O. Soares-Pinto, University of Sao Paulo, Brasil
5. dr William J. Munro, Basic Research Laboratories, NTT, Japan
6. dr hab. Tomasz Paterek, Institute of Theoretical Physics and Astrophysics, University of Gdańsk, Poland
7. dr Tomáš Novotný, Department of Solid State Physics, Charles University in Prague, Czech Republic
8. prof. Radim Filip, Department of Optics, Palacký University, Olomouc, Czech Republic
9. dr hab. Jarosław Korbicz, Center for Theoretical Physics, Polish Academy of Sciences, Warsaw, Poland
10. dr Karel Netočný, Institute of Physics, Czech Academy of Sciences

11. dr hab. Łukasz Cywiński, Institute of Physics, Polish Academy of Sciences, Warsaw, Poland
12. prof. William A. Coish, Department of Physics, McGill University, Montreal, Canada
13. prof. Paweł Horodecki & prof. Ryszard Horodecki, National Quantum Information Centre of Gdańsk, Poland
14. prof. Paweł Machnikowski, Department of Theoretical Physics, Wrocław University of Science and Technology, Poland
15. prof. Tilmann Kuhn, Institut für Festkörpertheorie, Westfälische Wilhelms-Universität Münster, Germany
16. prof. Vollrath Martin Axt, Physikalisches Institut, Universität Bayreuth, Germany
17. prof. Rolf Haug, NTH Nano, Leibniz Universität Hannover, Germany

Invited conference talks

1. K. Roszak, P. Machnikowski
Phonon induced decoherence of two-electron spin states in a double quantum dot
Nonequilibrium Nanostructures, International Workshop, Dresden, Germany (2008)
2. K. Roszak, P. Machnikowski, P. Horodecki, R. Horodecki
Entanglement measurement in dephased systems
Symposium KCIK, Sopot (2010)
3. K. Roszak, P. Mazurek, R. W. Chhajlany, and P. Horodecki
Magnetic field dependence of quantum dot spin qubit entanglement decay
EMN Fall, Orlando, USA (2013)
4. K. Roszak
A measure of qubit-environment entanglement for pure dephasing evolutions
XI Gdansk Symposium on Quantum Information, Sopot (2022)

Participation in evaluation panels

- 2016** Remote evaluator for H2020-FETOPEN-2016-2017-RIA, cut-off 06.16 (EU Commission)
- 2017** Remote evaluator for H2020-FETOPEN-2016-2017-RIA, cut-off 01.17 (EU Commission)
- 2017** Expert evaluator for Final Scientific Review (EU Commission)
- 2021** Expert evaluator for EIC PATHFINDER OPEN (EU Commission)
- 2022** Expert evaluator for EIC PATHFINDER OPEN (EU Commission)
- 2022** Expert evaluator for HORIZON MSCA (EU Commission)

Refereeing

Physical Review A
 Physical Review B
 Physical Review Research
 Physical Review X Quantum
 Physical Review Letters
 Quantum Science and Technology
 Scientific Reports

List of Publications

References

- [1] M. Jędrzejewski, K. Kinastowski, K. Roszak, *Convex-roof entanglement measures of density matrices block diagonal in disjoint subspaces for the study of thermal states*, Phys. Rev. A **105** (2022) 062419.
- [2] T. Harlender, K. Roszak, *Transfer and teleportation of system-environment entanglement*, Phys. Rev. A **105** (2022) 012407.
- [3] M. Strzałka, K. Roszak, *Detection of entanglement during pure dephasing evolutions for systems and environments of any size*, Phys. Rev. A **104** (2021) 042411.
- [4] B. Rzepkowski, K. Roszak, *A scheme for direct detection of qubit-environment entanglement generated during qubit pure dephasing*, Quant. Inf. Proc. **20** (2021) 1.
- [5] K. Roszak, Ł. Cywiński, *Qubit-environment-entanglement generation and the spin echo*, Phys. Rev. A **103** (2021) 032208.
- [6] K. Roszak, *Measure of qubit-environment entanglement for pure dephasing evolutions*, Phys. Rev. Research **2** (2020) 043062.
- [7] M. Strzałka, D. Kwiatkowski, Ł. Cywiński, K. Roszak, *Qubit-environment negativity versus fidelity of conditional environmental states for a nitrogen-vacancy-center spin qubit interacting with a nuclear environment*, Phys. Rev. A **102** (2020) 042602.
- [8] K. Roszak, J. Korbicz, *Glimpse of objectivity in bipartite systems for nonentangling pure dephasing evolutions*, Phys. Rev. A **101** (2020) 052120.
- [9] K. Roszak, J. Korbicz, *Entanglement and objectivity in pure dephasing models*, Phys. Rev. A **100** (2019) 062127.
- [10] K. Roszak, D. Kwiatkowski, Ł. Cywiński, *How to detect qubit-environment entanglement generated during qubit dephasing*, Phys. Rev. A **100** (2019) 022318.
- [11] K. Roszak, *Criteria for system-environment entanglement generation for systems of any size in pure-dephasing evolutions*, Phys. Rev. A **98** (2018) 052344.
- [12] K. Roszak, Ł. Cywiński, *Equivalence of qubit-environment entanglement and discord generation via pure dephasing interactions and the resulting consequences*, Phys. Rev. A **97** (2018) 012306.
- [13] T. Salamon, K. Roszak, *Entanglement generation between a charge qubit and its bosonic environment during pure dephasing: Dependence on the environment size*, Phys. Rev. A **96** (2017) 032333.
- [14] A. Radosz, P. Gusin, K. Roszak, *Disentanglement and Black Holes: Information Problem*, Acta Phys. Pol. A **132** (2017) 132-134.
- [15] J. Krzywda, K. Roszak, *Phonon-mediated generation of quantum correlations between quantum dot qubits*, Scientific Reports **6** (2016) 23753.

- [16] K. Roszak, Ł. Cywiński, *Characterization and measurement of qubit-environment entanglement generation during pure dephasing*, Phys. Rev. A **92** (2015) 032310.
- [17] K. Roszak, Ł. Cywiński, *The relation between the quantum discord and quantum teleportation: the physical interpretation of the transition point between different quantum discord decay regimes*, EPL **112** (2015) 10002.
- [18] K. Roszak, R. Filip, T. Novotný, *Decoherence control by quantum decoherence itself*, Scientific Reports **5** (2015) 9796.
- [19] K. Roszak, Ł. Marcinowski, P. Machnikowski, *Decoherence-enhanced quantum measurement of a quantum-dot spin qubit*, Phys. Rev. A **91** (2015) 032118.
- [20] P. Mazurek, K. Roszak, P. Horodecki, *The decay of quantum correlations between quantum dot spin qubits and the characteristics of its magnetic-field dependence*, EPL **107** (2014) 67004.
- [21] P. Mazurek, K. Roszak, R. W. Chhajlany, P. Horodecki, *Sensitivity of entanglement decay of quantum-dot spin qubits to the external magnetic field*, Phys. Rev. A **89** (2014) 062318.
- [22] P. Karwat, K. Gawarecki, K. Roszak, A. Sitek, P. Machnikowski, *Phonon-assisted processes and spontaneous emission in double quantum dots*, w: Quantum Dot Molecules, red. J. Wu, Z. M. Wang, Springer New York, New York, 2014, pp. 281-331.
- [23] Ł. Marcinowski, K. Roszak, P. Machnikowski, M. Krzyżosiak, *Phonon influence on the measurement of spin states in double quantum dots using the quantum point contact*, Phys. Rev. B **88** (2013) 125303.
- [24] K. Roszak, P. Mazurek, P. Horodecki, *Anomalous decay of quantum correlations of quantum-dot qubits*, Phys. Rev. A **87** (2013) 062308.
- [25] N. Ubbelohde, K. Roszak, F. Hohls, N. Maire, R. J. Haug, T. Novotný, *Shot-Noise at a Fermi-Edge Singularity: Non-Markovian Dynamics*, AIP Conf. Proc **1566** (2013) pp. 225-226.
- [26] N. Ubbelohde, K. Roszak, F. Hohls, N. Maire, R. J. Haug, T. Novotný, *Strong quantum memory at resonant Fermi edges revealed by shot noise*, Scientific Reports **2** (2012) 374.
- [27] K. Roszak, T. Novotný, *Non-Markovian effects at the Fermi-edge singularity in quantum dots*, Physica Scripta **T151** (2012) 014053.
- [28] Ł. Marcinowski, M. Krzyżosiak, K. Roszak, P. Machnikowski, *Phonon effects on the weak measurement of charge states in quantum dots with a quantum point contact*, Acta Phys. Pol. A **119** (2011) 640-643.
- [29] K. Roszak, P. Horodecki, R. Horodecki, *Sudden death of effective entanglement*, Phys. Rev. A **81** (2010) 042308.
- [30] K. Roszak, P. Machnikowski, V. M. Axt, T. Kuhn, *Spin decoherence of a confined exciton due to one- and two-phonon assisted transitions*, AIP Conf. Proc. **1199** (2010) pp. 413-414.
- [31] K. Roszak, P. Machnikowski, *Phonon-induced dephasing of singlet-triplet superpositions in double quantum dots without spin-orbit coupling*, Phys. Rev. B **80** (2009) 195315.
- [32] P. Machnikowski, K. Roszak, A. Sitek, *Collective luminescence and phonon induced processes in double quantum dots*, Acta Phys. Pol. A **116** (2009) 818.
- [33] Ł. Marcinowski, K. Roszak, P. Machnikowski, *Singlet-triplet dephasing in asymmetric quantum dot molecules*, Acta Phys. Pol. A **116** (2009) 874.

- [34] K. Roszak, P. Machnikowski, *Phonon induced pure dephasing of two electron spin states in vertical quantum dot molecules*, Acta Phys. Pol. A **116** (2009) 877.
- [35] K. Roszak, P. Machnikowski, V. M. Axt, T. Kuhn, *Exciton spin decay in quantum dots: single and double phonon assisted transitions*, Phys. Stat. Sol. (c) **6** (2009) 537.
- [36] K. Roszak, P. Machnikowski, V.M. Axt, T. Kuhn, *One and two phonon assisted transitions between exciton spin states in a quantum dot*, Acta Phys. Pol. A **114** (2008) 1329.
- [37] K. Roszak, V. M. Axt, T. Kuhn, P. Machnikowski, *Exciton spin decay in quantum dots to bright and dark states*, Phys. Rev. B **76** (2007) 195324.
- [38] K. Roszak, P. Machnikowski, L. Jacak, *Decay of entanglement due to pure dephasing: the role of geometry of entangled states*, Open Sys. Inf. Dyn. **14** (2007) 63.
- [39] K. Roszak, P. Machnikowski, *Complete disentanglement by partial pure dephasing*, Phys. Rev. A **73** (2006) 022313.
- [40] K. Roszak, P. Machnikowski, *“Which path” decoherence in quantum dot experiments*, Phys. Lett. A **351** (2006) 251-256.
- [41] K. Roszak, P. Machnikowski, L. Jacak, *Phonon-induced disentanglement of confined excitons*, Phys. Stat. Sol. (b) **243** (2006) 2261.
- [42] K. Roszak, P. Machnikowski, L. Jacak, *Phonon-induced dephasing in quantum dots - interpretation in terms of information leakage*, Acta Phys. Pol. A **110** (2006) 325.
- [43] K. Roszak, P. Machnikowski, L. Jacak, *Complete and partial loss of entanglement due to a phonon-assisted dephasing process*, Acta Phys. Pol. A **110** (2006) 331.
- [44] K. Roszak, P. Machnikowski, L. Jacak, *“Which way” interpretation of the dephasing of charge qubits in quantum dots*, J. Phys. Conf. Series **30** (2006) 52-55.
- [45] K. Roszak, A. Grodecka, P. Machnikowski, T. Kuhn, *Phonon-induced decoherence for a quantum dot spin qubit operated by Raman passage*, Phys. Rev. B **71** (2005) 195333 1-17.
- [46] A. Grodecka, L. Jacak, P. Machnikowski, K. Roszak, *Phonon impact on the coherent control of quantum states in semiconductor quantum dots*, w: Quantum Dots: Research Developments, red. P. A. Ling, Nova Science Publishers, New York, 2005, pp. 47-88.

Research projects

Polish grants: National Science Center and Ministry of Science

- No. 2012/05/B/ST3/02875, *Quantum measurement effects in quantum dot ensembles*, Institute of Physics, Wrocław University of Technology, 2012-2015 - **Head Investigator**
- No. 2015/19/B/ST3/03152, *Theoretical foundations of qubit-based environmental noise spectroscopy - quantum vs classical and Gaussian vs non-Gaussian noise*, Institute of Physics, Polish Academy of Sciences, 2016-2019 - **Senior Investigator**
- No. 2012/07/B/ST3/03616, *Dynamics of entanglement of localized spins in semiconductors with application to environmental noise spectroscopy*, Institute of Physics, Polish Academy of Sciences, 2013-2016 - **Senior Investigator**
- No. 2011/01/B/ST2/05459, *Sensitivity of correlated quantum dots systems to external magnetic fields due to interactions with the environment*, Gdańsk University of Technology, 2011-2015 - **Senior Investigator**

- No. 2011/01/B/ST3/02415, *Collective luminescence of quantum dots*, Wrocław University of Technology, 2011-2014 - **Senior Investigator**
- No. N N202 1336 33, *Ultrafast kinetics and nonlinear optical response of low-dimensional semiconductor structures: double quantum dots and quantum wells*, Wrocław University of Technology, 2007-2009 - **Investigator**

Other grants

- Czech Science Foundation No. 20-16577S, *Hybrid quantum physics at a low temperatures*, Palacký University Olomouc, 2020-2022 - **Investigator**
- Project TEAM (TEAM/2009-4/7), *Semiconductor nanostructures for renewable energy, information processing and communication technologies*, Wrocław University of Technology, 2010-2014 - **Investigator**
- Research Group Linkage Grant of the Alexander von Humboldt Foundation, *Optical properties, quantum optical control and dephasing in semiconductor nanostructures*, Wrocław University of Technology, 2010-2012 - **Investigator**
- Research Project 202/07.J051 (Bilateral Czech-German Grant), *Full counting statistics in non-markovian nano-systems*, Charles University in Prague, 2009-2010 - **Investigator**

Teaching experience

Students

- **PhD auxiliary advisor** for Paweł Mazurek (Gdańsk University) and Łukasz Marciniowski (Wrocław University of Technology)
- **MSc advisor** for Małgorzata Strzałka and Tytus Harlander (Wrocław University of Science and Technology)
- **BSc advisor** for Tymoteusz Salamon, Jan Krzywda, Małgorzata Strzałka, Rafał Rzempała, and Mikołaj Deszcz (Wrocław University of Science and Technology)

Taught lectures and tutorials

Quantum Correlations in Mixed states
 Introduction to the Theory of Transport through Nanostructures
 Open Quantum Systems
 Physics of Quantum Dots
 Quantum Mechanics 1 and 2
 Introduction to Quantum Mechanics for PhD students
 Advanced Quantum Mechanics (in english)
 Introduction to Quantum Optics (in english)
 General Physics 1, 2, and 3
 General Physics Laboratory

Organized conferences

- CCDS 2020, Ustroń, canceled due to COVID
 - member of the organizing committee

- OPON 2016, Wrocław, 17-19.02.2016
- member of the organizing committee
- EP2DS-20/MSS-16, Wrocław, 1-5.07.2013
- secretary and member of the organizing committee of both conferences
- OPON 2011, Wrocław, 14-16.02.2011
- member of the organizing committee