



Dr. Jacek Herbrych

Wrocław University of Science and Technology

✉ jacek.herbrych@pwr.edu.pl | 🏠 jacekherbrych.github.io

Appointments

Wrocław University of Science and Technology

INSTITUTE OF THEORETICAL PHYSICS · FACULTY OF FUNDAMENTAL PROBLEMS OF TECHNOLOGY

Group Leader · Assistant Professor

Wrocław, Poland

April 2019 - PRESENT

University of Tennessee

DEPARTMENT OF PHYSICS AND ASTRONOMY

Postdoctoral fellow with Prof. Elbio Dagotto and Prof. Adriana Moreo

Knoxville, USA

November 2016 - March 2019

Oak Ridge National Laboratory

MATERIALS SCIENCE AND TECHNOLOGY DIVISION

Associate scientist

Oak Ridge, USA

November 2016 - March 2019

University of Crete

DEPARTMENT OF PHYSICS

Postdoctoral fellow with Prof. Xenophon Zotos

Heraklion, Greece

January 2013 - August 2016

Jožef Stefan Institute

DEPARTMENT FOR THEORETICAL PHYSICS

Young researcher under supervision of Prof. Peter Prelovšek

Ljubljana, Slovenia

September 2010 - December 2013

Education

University of Warsaw

HABILITATION

Thesis: Properties of orbital-selective Mott insulators within low-dimensional multiorbital systems

Warsaw, Poland

October 2022

University of Ljubljana

PH.D. IN PHYSICS

Thesis: Finite-temperature dynamics of quantum spin chains

Advisor: Prof. Dr. Peter Prelovšek

Ljubljana, Slovenia

September 2010 - November 2013

University of Łódź

M.SC. IN PHYSICS

Thesis: Space-time symmetries in deformed Minkowski space

Advisor: Prof. Dr. Cezary Gonera

Łódź, Poland

September 2005 - July 2010

Funding

The National Science Centre (NCN)

Properties of low-dimensional quantum systems with charge, spin, and orbital degrees of freedom

SONATA BIS 13 2023/50/E/ST3/00033

Principal Investigator (Wrocław University of Science and Technology, Poland)

2024-2029

Past:

The National Science Centre (NCN)

Magnetic properties of strongly correlated multi-orbital systems

OPUS 18 2019/35/B/ST3/01207

2020-2023

Principal Investigator (Wrocław University of Science and Technology, Poland)

Polish National Agency for Academic Exchange (NAWA)

Polish Returns

PPN/PPO/2018/1/00035

2019-2022

Principal Investigator (Wrocław University of Science and Technology, Poland)

Teaching

Quantum Mechanics I & II

BACHELOR PROGRAM OF QUANTUM ENGINEERING

Wrocław University of Science and Technology, Poland

Quantum many-body theory

BACHELOR PROGRAM OF QUANTUM ENGINEERING AND MASTER PROGRAM OF TECHNICAL PHYSICS

Wrocław University of Science and Technology, Poland

Matrix product state representation of quantum mechanics

MONOGRAPHIC LECTURE; MASTER PROGRAM OF BIG DATA ANALYTICS

Wrocław University of Science and Technology, Poland

Numerical methods for quantum systems

MASTER PROGRAM OF QUANTUM ENGINEERING AND TECHNICAL PHYSICS

Wrocław University of Science and Technology, Poland

Publications

Evidence for valence-bond pairing in a one-dimensional two-orbital system

(57)

M. MIERZEJEWSKI, E. DAGOTTO, AND J. HERBRYCH

2025

Phys. Rev. B **112**, L041107 (2025) & arXiv: cond-mat/2411.03771

Spin and energy diffusion vs. subdiffusion in disordered spin chains

(56)

J. HERBRYCH AND P. PRELOVŠEK

2025

Phys. Rev. B **112**, 045108 (2025) & arXiv: cond-mat/2504.15705

Magnon damping and mode softening in quantum double-exchange ferromagnets

(55)

A. MOREO, E. DAGOTTO, G. ALVAREZ, T. TOHYAMA, M. MIERZEJEWSKI, AND J. HERBRYCH

2025

Rep. Prog. Phys. **88**, 068001 (2025) & arXiv: cond-mat/2503.01277

Luther-Emery liquid and dominant singlet superconductivity in the two-orbital Hubbard chain

(54)

P. LAURELL, J. HERBRYCH, G. ALVAREZ, AND E. DAGOTTO

2024

Phys. Rev. B **110**, 064515 (2024) & arXiv: cond-mat/2311.13440

Lindblad dynamics from spatio-temporal correlation functions in nonintegrable spin-1/2 chains with different boundary conditions

(53)

M. KRAFT, J. RICHTER, F. JIN, S. NANDY, ZALA LENARČIČ, J. HERBRYCH, K. MICHIENSEN, H. DE RAEDT, J. GEMMER, AND R. STEINIGEWEG

2024

Phys. Rev. Res. **6**, 023251 (2024) & arXiv: cond-mat/2402.18177

Long-living prethermalization in nearly integrable spin ladders

(52)

J. PAWŁOWSKI, M. PANFIL, J. HERBRYCH, AND M. MIERZEJEWSKI

2024

Phys. Rev. B **109**, L161109 (2024) & arXiv: cond-mat/2312.11975

Emergent dipole moment conservation and subdiffusion in tilted chains

(51)

S. NANDY, J. HERBRYCH, Z. LENARČIČ, A. GŁÓDKOWSKI, P. PRELOVŠEK, AND M. MIERZEJEWSKI

2024

Phys. Rev. B **109**, 115120 (2024) & arXiv: cond-mat/2310.01862

Transition to the Haldane phase driven by electron-electron correlations	(50)
A. JAŹDŹEWSKA, M. MIERZEJEWSKI, M. ŚRODA, A. NOCERA, G. ALVAREZ, E. DAGOTTO, AND <u>J. HERBRYCH</u>	2023
Nat. Commun. 14 , 8524 (2023) & arXiv: cond-mat/2304.11154	
The spin-1/2 XXZ chain coupled to two Lindblad baths: Constructing nonequilibrium steady states from equilibrium correlation functions	(49)
T. HEITMANN, J. RICHTER, F. JIN, S. NANDY, Z. LENARČIČ, <u>J. HERBRYCH</u> , K. MICHIENSEN, H. DE RAEDT, J. GEMMER, AND R. STEINIGEWEG	2023
Phys. Rev. B 108 , L201119 (2023) & arXiv: cond-mat/2303.00430	
Spatially-anisotropic $S = 1$ square-lattice antiferromagnet with single-ion anisotropy realized with a Ni(II) pyrazine-n,n'-dioxide (pyzdo) coordination polymer	(48)
J. L. MANSON, D. M. PAJEROWSKI, J. M. DONOVAN, B. TWAMLEY, P. A. GODDARD, R. JOHNSON, J. BENDIX, J. SINGLETON, T. LANCASTER, S. J. BLUNDELL, <u>J. HERBRYCH</u> , P. J. BAKER, A. J. STEELE, F. L. PRATT, I. FRANKE-CHAUDET, R. D. McDONALD, A. PLONCZAK, AND P. MANUEL	2023
Phys. Rev. B 108 , 094425 (2023)	
Spin diffusion in perturbed isotropic Heisenberg spin chain	(47)
S. NANDY, Z. LENARČIČ, E. ILIEVSKI, M. MIERZEJEWSKI, <u>J. HERBRYCH</u> , P. PRELOVŠEK	2023
Phys. Rev. B 108 , L081115 (2023) & arXiv: cond-mat/2211.17181	
Real-time broadening of bath-induced density profiles from closed-system correlation functions	(46)
T. HEITMANN, J. RICHTER, <u>J. HERBRYCH</u> , J. GEMMER, AND R. STEINIGEWEG	2023
Phys. Rev. E 108 , 024102 (2023) & arXiv: cond-mat/2210.10528	
Hund bands in spectra of multiorbital systems	(45)
M. ŚRODA, J. MRAVLJE, G. ALVAREZ, E. DAGOTTO, AND <u>J. HERBRYCH</u>	2023
Phys. Rev. B 108 , L081102 (2023) & arXiv: cond-mat/2210.11209	
Slow diffusion and Thouless localization criterion in modulated spin chains	(44)
M. MIERZEJEWSKI, <u>J. HERBRYCH</u> , AND P. PRELOVŠEK	2023
Phys. Rev. B 108 , 035106 (2023) & arXiv: cond-mat/2302.03325	
Quasiballistic transport in long-range anisotropic Heisenberg model	(43)
M. MIERZEJEWSKI, J. WRONOWICZ, J. PAWŁOWSKI, AND <u>J. HERBRYCH</u>	2023
Phys. Rev. B 107 , 045134 (2023) & arXiv: cond-mat/2206.05960	
From dissipationless to normal diffusion in easy-axis Heisenberg spin chain	(42)
P. PRELOVŠEK, S. NANDY, Z. LENARČIČ, M. MIERZEJEWSKI, AND <u>J. HERBRYCH</u>	2022
Phys. Rev. B 106 , 245104 (2022) & arXiv: cond-mat/2205.11891	
Multiple relaxation times in perturbed XXZ chain	(41)
M. MIERZEJEWSKI, J. PAWŁOWSKI, P. PRELOVŠEK, AND <u>J. HERBRYCH</u>	2022
SciPost Phys. 13 , 013 (2022) & arXiv: cond-mat/2112.08158	
High-pressure inelastic neutron scattering study of the anisotropic $S = 1$ spin chain $[\text{Ni}(\text{HF}_2)_4(3\text{-Clpyridine})_4]\text{BF}_4$	(40)
D. M. PAJEROWSKI, A. P. PODLESNYAK, <u>J. HERBRYCH</u> , AND J. L. MANSON	2022
Phys. Rev. B 105 , 134420 (2022) & arXiv: cond-mat/2206.06249	
Relaxation at different length-scales in models of many-body localization	(39)
<u>J. HERBRYCH</u> , M. MIERZEJEWSKI, AND P. PRELOVŠEK	2022
Phys. Rev. B 105 , L081105 (2022) & arXiv: cond-mat/2110.15635	
Prediction of orbital selective Mott phases and block magnetic states in the quasi-one-dimensional iron chain $\text{Ce}_2\text{O}_2\text{FeSe}_2$ under hole and electron doping	(38)
L.-F. LIN, Y. ZHANG, G. ALVAREZ, <u>J. HERBRYCH</u> , A. MOREO, AND E. DAGOTTO	2022
Phys. Rev. B 105 , 075119 (2022) & arXiv: cond-mat/2112.04049	
Magnetization dynamics fingerprints of an excitonic condensate t_{2g}^4 magnet	(37)
N. KAUSHAL, <u>J. HERBRYCH</u> , G. ALVAREZ, AND E. DAGOTTO	2021
Phys. Rev. B 104 , 235135 (2021) & arXiv: cond-mat/2110.11828	

Coexistence of diffusive and ballistic transport in integrable quantum lattice models	(36)
P. PRELOVŠEK, M. MIERZEJEWSKI, AND <u>J. HERBRYCH</u>	2021
Phys. Rev. B 104 , 115163 (2021) & arXiv: cond-mat/2107.02454	
Quantum magnetism of iron-based ladders: blocks, spirals, and spin flux	(35)
M. ŚRODA, E. DAGOTTO, AND <u>J. HERBRYCH</u>	2021
Phys. Rev. B 104 , 045128 (2021) & arXiv: cond-mat/2105.04391	
Diffusion in the Anderson model in higher dimensions	(34)
P. PRELOVŠEK AND <u>J. HERBRYCH</u>	2021
Phys. Rev. B 103 , L241107 (2021) & arXiv: cond-mat/2104.07801	
Ballistic transport in integrable lattice models with degenerate spectra	(33)
M. MIERZEJEWSKI, <u>J. HERBRYCH</u> , AND P. PRELOVŠEK	2021
Phys. Rev. B 103 , 235115 (2021) & arXiv: cond-mat/2102.07467	
Interaction-induced topological phase transition and Majorana edge states in low-dimensional orbital-selective Mott insulators	(32)
<u>J. HERBRYCH</u> , M. ŚRODA, G. ALVAREZ, M. MIERZEJEWSKI, AND E. DAGOTTO	2021
Nat. Commun. 12 , 2955 (2021) & arXiv: cond-mat/2011.05646	
Resistivity and its fluctuations in disordered many-body systems: from chains to planes	(31)
M. MIERZEJEWSKI, M. ŚRODA, <u>J. HERBRYCH</u> , AND P. PRELOVŠEK	2020
Phys. Rev. B 102 , 161111(R) (2020) & arXiv: cond-mat/2003.00495	
Block orbital-selective Mott insulators: a spin excitation analysis	(30)
<u>J. HERBRYCH</u> , G. ALVAREZ, A. MOREO, AND E. DAGOTTO	2020
Phys. Rev. B 102 , 115134 (2020) & arXiv: cond-mat/2006.09495	
Prediction of exotic magnetic states in the alkali metal quasi-one-dimensional iron selenide compound Na_2FeSe_2	(29)
B. PANDEY, L.-F. LIN, R. SONI, N. KAUSHAL, <u>J. HERBRYCH</u> , G. ALVAREZ, AND E. DAGOTTO	2020
Phys. Rev. B 102 , 035149 (2020) & arXiv: cond-mat/2005.13132	
Block-spiral magnetism: An exotic type of frustrated order	(28)
<u>J. HERBRYCH</u> , J. HEVERHAGEN, G. ALVAREZ, M. DAGHOFFER, A. MOREO, AND E. DAGOTTO	2020
Proc. Natl. Acad. Sci. USA 117 , 16226 (2020) & arXiv: cond-mat/1911.12248	
Vanishing Wilson ratio as the hallmark of quantum spin-liquid models	(27)
P. PRELOVŠEK, K. MORITA, T. TOHYAMA, AND <u>J. HERBRYCH</u>	2020
Phys. Rev. Research 2 , 023024 (2020) & arXiv: cond-mat/1912.00876	
Inelastic neutron scattering study of the anisotropic $S = 1$ spin chain $[\text{Ni}(\text{HF}_2)(3\text{-Clpyridine})_4]\text{BF}_4$	(26)
D. M. PAJEROWSKI, J. L. MANSON, <u>J. HERBRYCH</u> , J. BENDIX, A. P. PODLESNYAK, J. M. CAIN, AND M. W. MEISEL	2020
Phys. Rev. B 101 , 094431 (2020) & arXiv: cond-mat/2001.08555	
Charge-density-wave melting in the one-dimensional Holstein model	(25)
J. STOLPP, <u>J. HERBRYCH</u> , F. DORFNER, E. DAGOTTO, AND F. HEIDRICH-MEISNER	2020
Phys. Rev. B 101 , 035134 (2020) & arXiv: cond-mat/1911.01718	
Novel Magnetic Block States in Low-Dimensional Iron-Based Superconductors	(24)
<u>J. HERBRYCH</u> , J. HEVERHAGEN, N. D. PATEL, G. ALVAREZ, M. DAGHOFFER, A. MOREO, AND E. DAGOTTO	2019
Phys. Rev. Lett. 123 , 027203 (2019) & arXiv: cond-mat/1812.00325	
Magnetization and energy dynamics in spin ladders:	(23)
Evidence of diffusion in time, frequency, position, and momentum	
J. RICHTER, F. JIN, L. KNIPSCHILD, <u>J. HERBRYCH</u> , H. DE RAEDT, K. MICHELSSEN, J. GEMMER, AND R. STEINIGEWEG	2019
Phys. Rev. B 99 , 144422 (2019) & arXiv: cond-mat/1811.02806	
Sudden removal of a static force in a disordered system: Induced dynamics, thermalization, and transport	(22)
J. RICHTER, <u>J. HERBRYCH</u> , AND R. STEINIGEWEG	2018
Phys. Rev. B 98 , 134302 (2018) & arXiv: cond-mat/1808.00497	

Non-equilibrium mass transport in the Fermi-Hubbard model	(21)
S. SCHERG, T. KOHLERT, <u>J. HERBRYCH</u> , J. STOLPP, P. BORDIA, U. SCHNEIDER, F. HEIDRICH-MEISNER, I. BLOCH, AND M. AIDELSBURGER	2018
Phys. Rev. Lett. 121 , 130402 (2018) & arXiv: cond-mat/1805.10990	
Spin dynamics of the block orbital-selective Mott phase	(20)
<u>J. HERBRYCH</u> , N. KAUSHAL, A. NOCERA, G. ALVAREZ, A. MOREO, AND E. DAGOTTO	2018
Nat. Commun. 9 , 3736 (2018) & arXiv: cond-mat/1804.01959	
Density-matrix renormalization group study of a three-orbital Hubbard model with spin-orbit coupling in one dimension	(19)
N. KAUSHAL, <u>J. HERBRYCH</u> , A. NOCERA, G. ALVAREZ, A. MOREO, F. A. REBOREDO, AND E. DAGOTTO	2017
Phys. Rev. B 96 , 155111 (2017) & arXiv: cond-mat/1707.04313	
Efficiency of fermionic quantum distillation	(18)
<u>J. HERBRYCH</u> , A. E. FEIGUIN, E. DAGOTTO, AND F. HEIDRICH-MEISNER	2017
Phys. Rev. A 96 , 033617 (2017) & arXiv: cond-mat/1707.01792	
Possible bicollinear nematic state with monoclinic lattice distortions in iron telluride compounds	(17)
C. B. BISHOP, <u>J. HERBRYCH</u> , E. DAGOTTO, AND A. MOREO	2017
Phys. Rev. B 96 , 035144 (2017) & arXiv: cond-mat/1704.03495	
Self-consistent approach to many-body localization and subdiffusion	(16)
P. PRELOVŠEK AND <u>J. HERBRYCH</u>	2017
Phys. Rev. B 96 , 035130 (2017) & arXiv: cond-mat/1609.05450	
Dynamics of locally coupled oscillators with next-nearest-neighbor interaction	(15)
<u>J. HERBRYCH</u> , A. G. CHAZIRAKIS, N. CHRISTAKIS, AND J. J. P. VEERMAN	2017
Differ. Equ. & Dyn. Syst. 29 , 487 (2021) & arXiv: math/1506.07381	
Density correlations and transport in models of many-body localization	(14)
P. PRELOVŠEK, M. MIERZEJEWSKI, O. BARIŠIĆ, AND <u>J. HERBRYCH</u>	2017
Ann. Phys. (Berlin) 529 , 1600362 (2017) & arXiv: cond-mat/1611.03611	
Interaction-induced weakening of localization in few-particle disordered Heisenberg chains	(13)
D. SCHMIDTKE, R. STEINIGEWEG, <u>J. HERBRYCH</u> , AND J. GEMMER	2017
Phys. Rev. B 95 , 134201 (2017) & arXiv: cond-mat/1607.05664	
Effective realization of random magnetic fields in compounds with large single-ion anisotropy	(12)
<u>J. HERBRYCH</u> AND J. KOKALJ	2017
Phys. Rev. B 95 , 125129 (2017) & arXiv: cond-mat/1606.06013	
Universal dynamics of density correlations at the transition to many-body localized state	(11)
M. MIERZEJEWSKI, <u>J. HERBRYCH</u> , AND P. PRELOVŠEK	2016
Phys. Rev. B 94 , 224207 (2016) & arXiv: cond-mat/1607.04992	
Typicality approach to the optical conductivity in thermal and many-body localized phases	(10)
R. STEINIGEWEG, <u>J. HERBRYCH</u> , F. POLLMANN, AND W. BRENIG	2016
Phys. Rev. B 94 , 180401(R) (2016) & arXiv: cond-mat/1512.08519	
Light induced magnetization in a spin $S = 1$ easy-plane antiferromagnetic chain	(9)
<u>J. HERBRYCH</u> AND X. ZOTOS	2016
Phys. Rev. B 93 , 134412 (2016) & arXiv: cond-mat/1505.03004	
Heat conductivity of the Heisenberg spin-1/2 ladder: From weak to strong breaking of integrability	(8)
R. STEINIGEWEG, <u>J. HERBRYCH</u> , X. ZOTOS, AND W. BRENIG	2016
Phys. Rev. Lett. 116 , 017202 (2016) & arXiv: cond-mat/1503.03871	
Antiferromagnetic order in weakly coupled random spin chains	(7)
J. KOKALJ, <u>J. HERBRYCH</u> , A. ZHELUDEV, AND P. PRELOVŠEK	2015
Phys. Rev. B 91 , 155147 (2015) & arXiv: cond-mat/1409.1757	

- Effective $S = 1/2$ description of the $S = 1$ chain with strong easy plane anisotropy** (6)
 C. PSAROUDAKI, J. HERBRYCH, J. KARADAMOGLU, P. PRELOVŠEK, X. ZOTOS, AND N. PAPANICOLAOU 2014
 Phys. Rev. B **89**, 224418 (2014) & arXiv: cond-mat/1404.3064
- Local spin relaxation within the random Heisenberg chain** (5)
J. HERBRYCH, J. KOKALJ, AND P. PRELOVŠEK 2013
 Phys. Rev. Lett. **111**, 147203 (2013) & arXiv: cond-mat/1307.0370
- Eigenstate thermalization in isolated spin-chain systems** (4)
 R. STEINIGEWEG, J. HERBRYCH, AND P. PRELOVŠEK 2013
 Phys. Rev. E **87**, 012118 (2013) & arXiv: cond-mat/1208.6143
- Spin hydrodynamics in the $S = 1/2$ anisotropic Heisenberg chain** (3)
J. HERBRYCH, R. STEINIGEWEG, AND P. PRELOVŠEK 2012
 Phys. Rev. B **86**, 115106 (2012) & arXiv: cond-mat/1206.4248
- Coexistence of anomalous and normal diffusion in integrable Mott insulators** (2)
 R. STEINIGEWEG, J. HERBRYCH, P. PRELOVŠEK, AND M. MIERZEJEWSKI 2012
 Phys. Rev. B **85**, 214409 (2012) & arXiv: cond-mat/1201.2844
- Finite-temperature Drude weight within the anisotropic Heisenberg chain** (1)
J. HERBRYCH, P. PRELOVŠEK, AND X. ZOTOS 2011
 Phys. Rev. B **84**, 155125 (2011) & arXiv: cond-mat/1107.3027