Dr. Jacek **Herbrych**

Wrocław University of Science and Technology

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

Appointments

Wrocław University of Science and Technology — *Wrocław, Poland*

Institute of Theoretical Physics · Faculty of Fundamental Problems of Technology — *April 2019 - PRESENT*

Group Leader · Associate Professor

University of Tennessee — *Knoxville, USA*

Department of Physics and Astronomy — *November 2016 - March 2019*

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

Oak Ridge National Laboratory — *Oak Ridge, USA*

Materials Science and Technology Division — *November 2016 - March 2019*

Associate scientist

University of Crete — *Heraklion, Greece*

Department of Physics — *January 2013 - August 2016*

Postdoctoral fellow with Prof. Xenophon Zotos

Jožef Stefan Institute — *Ljubljana, Slovenia*

Department for Theoretical Physics — *September 2010 - December 2013*

Young researcher under supervision of Prof. Peter Prelovšek

Education

University of Warsaw — *Warsaw, Poland*

Habilitation — *October 2022*

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

University of Ljubljana — *Ljubljana, Slovenia*

Ph.D. in Physics — *September 2010 - November 2013*

Thesis: Finite-temperature dynamics of quantum spin chains

Advisor: Prof. Dr. Peter Prelovšek

University of Łódź — *Łódź, Poland*

M.Sc. in Physics — *September 2005 - July 2010*

Thesis: Space-time symmetries in deformed Minkowski space

Advisor: Prof. Dr. Cezary Gonera

Funding

Japan Society for the Promotion of Science (JSPS)

Invitational Fellowships for Research in Japan — *VII.2026-IX.2026*

Visiting Scientist of Prof. Takami Tohyama (Tokyo University of Science, Japan)

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 — *2024-2029*

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

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

Doping $S = 1$ antiferromagnet in one-dimension *(60)*

J. Prokopczyk and J. Herbrych *2025*

Phys. Rev. B **113**, 024424 (2026) & arXiv: cond-mat/2508.07712

Tunable Hilbert space fragmentation and extended critical regime *(59)*

M. Lisiecki, J. Bonča, M. Mierzejewski, J. Herbrych, and P. Łydżba *2025*

Phys. Rev. B **112**, 195116 (2025) & arXiv: cond-mat/2505.09346

Finding local integrals of motion in quantum lattice models in the thermodynamic limit *(58)*

J. Pawłowski, J. Herbrych, and M. Mierzejewski *2025*

Phys. Rev. B **112**, 155130 (2025) & arXiv: cond-mat/2505.05882

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. Michielsen, 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. Jażdżewska, M. Mierzejewski, M. Środa, A. Nocera, G. Alvarez, E. Dagotto, and J. Herbrych *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, J. Herbrych, K. Michielsen, 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, J. Herbrych, 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, J. Herbrych, 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, J. Herbrych, 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 J. Herbrych *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, J. Herbrych, 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 J. Herbrych *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 J. Herbrych *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 J. Herbrych *2022*

SciPost Phys. **13**, 013 (2022) & arXiv: cond-mat/2112.08158

High-pressure inelastic neutron scattering study of the anisotropic $S = 1$ spin chain [Ni(HF$_2$)(3-Clpyridine)$_4$]BF$_4$ *(40)*

D. M. Pajerowski, A. P. Podlesnyak, J. Herbrych, 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)*

J. Herbrych, 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 Ce$_2$O$_2$FeSe$_2$ under hole and electron doping *(38)*

L.-F. Lin, Y. Zhang, G. Alvarez, J. Herbrych, 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, J. Herbrych, 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 J. Herbrych *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 J. Herbrych *2021*

Phys. Rev. B **104**, 045128 (2021) & arXiv: cond-mat/2105.04391

Diffusion in the Anderson model in higher dimensions *(34)*

P. Prelovšek and J. Herbrych *2021*

Phys. Rev. B **103**, L241107 (2021) & arXiv: cond-mat/2104.07801

Ballistic transport in integrable lattice models with degenerate spectra *(33)*

M. Mierzejewski, J. Herbrych, 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)*

J. Herbrych, 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, J. Herbrych, 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)*

J. Herbrych, 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$_2$FeSe$_2$ *(29)*

B. Pandey, L.-F. Lin, R. Soni, N. Kaushal, J. Herbrych, 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)*

J. Herbrych, J. Heverhagen, G. Alvarez, M. Daghofer, 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 J. Herbrych *2020*

Phys. Rev. Research **2**, 023024 (2020) & arXiv: cond-mat/1912.00876

Inelastic neutron scattering study of the anisotropic $S = 1$ spin chain [Ni(HF$_2$)(3-Clpyridine)$_4$]BF$_4$ *(26)*

D. M. Pajerowski, J. L. Manson, J. Herbrych, 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, J. Herbrych, 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)*

J. Herbrych, J. Heverhagen, N. D. Patel, G. Alvarez, M. Daghofer, A. Moreo, and E. Dagotto *2019*

Phys. Rev. Lett. **123**, 027203 (2019) & arXiv: cond-mat/1812.00325

Magnetization and energy dynamics in spin ladders:
Evidence of diffusion in time, frequency, position, and momentum *(23)*

J. Richter, F. Jin, L. Knipschild, J. Herbrych, H. De Raedt, K. Michielsen, 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, J. Herbrych, 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, J. Herbrych, 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)*

J. Herbrych, 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, J. Herbrych, 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)*

J. Herbrych, 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, J. Herbrych, 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 J. Herbrych *2017*

Phys. Rev. B **96**, 035130 (2017) & arXiv: cond-mat/1609.05450

Dynamics of locally coupled oscillators with next-nearest-neighbor interaction *(15)*

J. Herbrych, 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 J. Herbrych *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, J. Herbrych, 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)*

J. Herbrych 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, J. Herbrych, 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, J. Herbrych, 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)*

J. Herbrych 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, J. Herbrych, 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, J. Herbrych, 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. Karadamoglou, 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