Curriculum Vitae – Jaka Vodeb

Personal Data

Name: Jaka
Surname: Vodeb
Birth date: 17 November 1993
Nationality: Slovenian

jaka.vodeb@ijs.si
ResearcherID: V-3831-2018

Current Employment

Feb 2025 – Present **Research Associate**
Department of Complex Matter - F7, Jožef Stefan Institute, Ljubljana, Slovenia

Education

2017-2021: **Ph.D. in Physics**
Title: "Configurational Electronic States in Layered Transition Metal Dichalcogenides"
Qualification: Cum Laude
Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia

2015-2017: **MSc in Physics**
GPA 9.57/10
Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia

2012-2015: **BSc in Physics**
Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia

Academic Research Titles

- Jožef Stefan Institute: Research Associate
- University of Ljubljana: Teaching Assistant

Employment

Dec 2024 – Jan 2023 **Postdoctoral Researcher**
Quantum Information Processing Group, Jülich Supercomputing Centre, Forschungzentrum Jülich, Germany

Dec 2022 – Jan 2022 **Postdoctoral Researcher**
Department of Complex Matter - F7, Jožef Stefan Institute, Ljubljana, Slovenia

Dec 2021 – Oct 2017 **PhD Student – Young Researcher**
Department of Complex Matter - F7, Jožef Stefan Institute, Ljubljana, Slovenia

Awards

Apr 2019 **Best student talk award**
Granted by the organizers of the Study of Matter at Extreme Conditions conference.

Jun 2023 **AQC 2023 Junior Scientist Scholarship**
Granted by the organizers of the Adiabatic Quantum Computing conference.

Nov 2023 **The Blaise Pascal [Re]generative Quantum Challenge Hackathon Finalist**
Granted by the company PASQAL for solving a UN sustainable development goal using neutral atom quantum computers.

Jun 2024 **Dr. Ane Mayer Kansky Award**
Granted by the University of Ljubljana to the best PhDs defended in the 3 years prior to 2024.

Participation in Research Projects

Project Title: Marie Skłodowska-Curie Actions Cofund project (European Comission) "Slovenian Quantum Science Hub (SQUASH)", Grant No. 101177446
Funding agency: European Research Council - ERC (2026-2031)
Researcher in charge: Prof. Dr. Andrej Zorko

Project Title: Quantum solver for hard BInary Quadratic problems (QBIQ)
Funding agency: Slovenian Research Agency (2025-2027)
Researcher in charge: Prof. Dr. Janez Povh

Project Title: HIMMS – Hiden metastable mesoscopic states in quantum materials
Funding agency: European Research Council - ERC (2024-2029)
Researcher in charge: Prof. Dr. Dragan D. Mihailović

Project Title: Physics of quantum technologies (Project No. P1-0416)
Funding agency: Slovenian Research Agency (2022-2027)
Researcher in charge: Prof. Dr. Rok Žitko

Project title: Non-equilibrium Quantum System Dynamics (Project No. P1-0040)
Funding agency: Slovenian Research Agency (2022-2027)
Researcher in charge: Prof. Dr. Dragan D. Mihalović

Project Title: Memory devices based on charge configuration and controlled by SFQ pulses (Project No. J7-3146)
Funding agency: Slovenian Research Agency (2021-2024)
Researcher in charge: Prof. Dr. Dragan D. Mihalović

Project Title: Multi-scale modelling of non-equilibrium quantum materials (Project No. J1-2455)
Funding agency: Slovenian Research Agency (2020-2024)
Researcher in charge: Dr. Denis Golež

Project Title: Stabilization and destabilization of spin liquids due to perturbations (Project No. N1-0148)
Funding agency: Slovenian Research Agency (2020-2023)
Researcher in charge: Assoc. Prof. Dr. Andrej Zorko

Project Title: Jülich UNified Infrastructure for Quantum computing (JUNIQ)
Funding agency: German Federal Ministry of Education and Research (BMBF) and the Ministry of Culture and Science of the State of North Rhine-Westphalia (2019-2024)
Researcher in charge: Prof. Dr. Kristel Michielsen

Project Title: Coherent trajectories through symmetry breaking transitions – TRAJECTORY
Funding agency: European Research Council - ERC (2013-2018)
Researcher in charge: Prof. Dr. Dragan D. Mihailović

Research Internships

- **Department of Complex Matter Physics F7, Jožef Stefan Institute, Ljubljana, Slovenia**
  Project: Nematic liquid crystals with gold nanorods: measurements and modelling.
  Dates: 5 months: March-June 2016

Commissions of trust

- **Invited member of the advisory board on quantum technologies to the Slovenian government**
  2025 – present
- **Member of the management board of the International Network on Quantum Annealing (INQA)**

2026 – present

Teaching and Supervision

Teaching Assistant

Academic periods: 2018/19, 2019/20, 2020/21, 2021/22
"Physics" Degree of Computer and Information Science (B.Sc.), Faculty of Computer and Information Science, University of Ljubljana, Slovenia

JUNIQ Summer School on Quantum Information Processing 2023 – Gate-based and Annealing Systems

Aug 2023, Quantum simulation using quantum annealers and Developing a theory of macroscopic resonant tunnelling of flux in a double-well potential in the presence of realistic flux noise - a pen & paper exercise, 50 early PhD students, Jülich Supercomputing Centre, Forschungszentrum Jülich

JUNIQ Spring School on Quantum Information Processing 2025 – Gate-based and Annealing Systems

Apr 2025, Introduction to neutral atom quantum computing and Quantum Simulation, 20 early PhD students, Jülich Supercomputing Centre, Forschungszentrum Jülich

JUNIQ Summer School on Quantum Information Processing 2024 – Gate-based and Annealing Systems

Aug 2024, Introduction to neutral atom quantum computing and Quantum Simulation, 20 early PhD students, Jülich Supercomputing Centre, Forschungszentrum Jülich

JUNIQ/EPIQ Summer School on Quantum Computing - Applications across Digital and Analog Architectures

Sep 2025, Quantum simulation, 20 early PhD students, Jülich Supercomputing Centre, Forschungszentrum Jülich

Successful Twinning: Quantum Computing Invited Lecture

Oct 2023, Introduction to quantum computing, 70 undergraduate and graduate students, University of Donja Gorica (UDG) and NCC Montenegro

Undergraduate Course Computer Technologies Invited Lecture

May 2024, Adiabatic quantum computing, 15 undergraduate students, Faculty of Computer and Information Science, University of Ljubljana

Physics in Ljubljana Summer School 2024: Invited Lecture

Jul 2024, Quantum Simulation and Computation, 70 undergraduate and graduate students, Faculty of Mathematics and Physics, University of Ljubljana

Summer School for High School Students "Poletna šola FMF 2022"

Aug 2022, Quantum Computing, 20 high school students, Faculty of Mathematics and Physics, University of Ljubljana

Co-advising MSc thesis

2023, student: Gregor Humar, title: False Vacuum Decay in the Transverse-Field Ising Model on a Quantum Annealer, Faculty of Mathematics and Physics, University of Ljubljana

Co-advising Erasmus internship

Mar-Jun 2025, Lev Podbregar, title: Modelling the qubit measurement process, Jülich Supercomputing Centre, Forschungszentrum Jülich

Co-advising PhD thesis in progress

2023-present, Gregor Humar, title: Non-equilibrium dynamics simulations of the Ising model in a transverse and longitudinal field on quantum devices, Faculty of Mathematics and Physics, University of Ljubljana

Co-advising PhD thesis in progress

2023-present, Andrea Rava, title: Quantum simulators: theory and applications, Jülich Supercomputing Centre, Forschungszentrum Jülich

Departmental Service and Academic Leadership

Coordinator and organizer of F7 Departmental Seminars, Jožef Stefan Institute (2025–present)

Public Outreach and Dissemination

Education of Slovenian High School Teachers

2019, Presenting quantum computing to Slovenian high school teachers at *"Sedemdeset let DMFA Slovenije"*, Ljubljana

2025, Workshop on "Quantum Computing" for high-school teachers at the Faculy of Mathematics and Physics

Public Event

27.11.2020, 24.9.2021, 30.9.2022, Presenting superconductivity to the general public at "*Noč ima svojo moč*",

Jožef Stefan Institute, Ljubljana
April 14, 2022, Virtual workshop or high school students on World Quantum Day: "Where to Sit in a Classroom Using a Quantum Computer?"

Radio or TV Event

July 2019, National TV Interview on POP TVs 24 ur zvečer, *"Izjemni slovenski znanstveniki postavili nov mejnik na področju kvantne fizike"* , Ljubljana, Slovenia
July 2019, National TV Interview on POP TVs 24 ur, *"Nov mejnik v kvantni fiziki"*, Ljubljana, Slovenia
Jan 2021, Radio Interview on VAL 202, *"Kvantna prihodnost 1/3: Prvi koraki do kvantne premoči"*, Ljubljana, Slovenia
Jun 2021, Feature on national news RTV SLO, *IJS: "Dosežek bi lahko vodil do nadaljnjega manjšanja čipov"*, Ljubljana, Slovenia
2022, Podcast interview on Radio Študent: "*Prva kvantna Zoffa*", Ljubljana, Slovenia
2025, Radio interview on ARS: "Podobe znanja", Ljubljana, Slovenia
2025, Radio interview on RTVSLO1: "Radiosfera", Ljubljana, Slovenia

Newspaper Interview

July 2024, Scientist profile interview in the national newspaper Delo, "*Z reševanjem težkih problemov postajam boljša različica sebe*", Ljubljana, Slovenia
Feb 2025, Jülich Supercomputing Centre News, "Interview: Dr Jaka Vodeb on possible quantum processes in the creation of the world"
Feb 2025, Scientific American, "Interview: Quantum Simulation Shows How Universe-Destroying 'Bubbles' Could Grow"

News Feature

2023, Časopis IJS, Raziskovalci IJS uspeli minimizirati šum v kvantnih žarilnikih
Jun 2024, multiple new features on the publication "Non-equilibrium quantum domain reconfiguration dynamics in a two-dimensional electronic crystal and a quantum annealer" published in *Nature Communications* including news outlets such as Phys.org, Mirage News, Informationsdienst Wissenschaft, MSN, Innovations Report, Chem Europe, Chemie.de, Scitech Daily
Oct 2024, Novice IJS, Neravnovesna kvantna dinamika rekonfiguracije domen v dvodimenzionalnem elektronskem kristalu in kvantnem žarilniku
Feb-Mar 2025, multiple new features on the publication "Stirring the false vacuum via interacting quantized bubbles on a 5564-qubit quantum annealer" published in *Nature Physics* including news outlets such as Phys.org, EurekAlert, COSMOS magazine, The Independent, Yahoo! News, Mirage News, AOL, Informationsdienst Wissenschaft, MSN, Innovations Report, ScienMag, Bioengineer.org, Science Daily, My Science, Enerzine, Sky Nightly, Ingenieur.de, Space Daily, Popmech, Naked Science, Pledge Times, Tech Explorist, MarketScreener, Der Standard, Futurism, Gizmodo, 24ur, Delo, STA, N1, RTV, Dnevnik, Metropolitan, Mladina, Lokalec, SiOL, Novice24, Megafon, Aktualno24, 1zavse, Gorenjski glas

Invited Public Lecture

Jun 2019, Seminar on Quantum Technology at Qutes "*Adiabatic quantum computing: what is it and what it looks like today"*, Ljubljana

YouTube video

2020, Contributed talk presented at Qubits 2020 - faster forward, "*Simulating quantum configurational tunneling using machine learning assisted quantum computation"*, https://www.youtube.com/watch?v=-KaroBsoYZM&list=PLPvKnT7dgEsvCRJ8cnvox-DzBLSgZAPOO&index=19
Oct 2024, Invited talk at the INQA seminar series, "*Stirring the false vacuum via interacting quantized bubbles on a 5564-qubit quantum annealer*", University College London, London, https://www.youtube.com/watch?v=g9QdBDcJb-Q

Blog

2025, Blog post at the Nature portfolio physics community, "*Simulating the cosmic dance of false vacuum bubbles with a quantum annealer: behind the paper"*
2025, Blog post at the Nature portfolio physics community, "*Quantum annealer unlocks new insights into many-body quantum systems: behind the paper"*

Summary of Publications

ResearcherID: V-3831-2018 // Sicris number 50514

12 Scientific papers of which
4 as first author and 1 as leading author.
Total number of citations: 324 (Google Scholar)
h-index : 8

Full list of publications in Annex 1

Summary of Participation in Conferences

Participation in 22 International Conferences
9 Invited Oral
1 Plenary Oral
13 Oral Contributions as presenting author
38 Poster Contributions

Full list of Conferences in Annex 2

ANNEX 1 – List of Publications

1) **"Stirring the false vacuum via interacting quantized bubbles on a 5564-qubit quantum annealer" VODEB, Jaka**, DESAULES, J.Y., HALLAM, A., RAVA, A., HUMAR, G., WILLSCH, D., JIN, F., WILLSCH, M., MICHIELSEN, K., PAPIĆ, Z. *Nature Physics* **(2025). https://doi.org/10.1038/s41567-024-02765-w**

2) **"Non-equilibrium quantum domain reconfiguration dynamics in a two-dimensional electronic crystal and a quantum annealer" VODEB, Jaka**, DIEGO, Michele, VASKIVSKYI, Yevhenii, LOGARIČ, Leonard, GERASIMENKO, Yaroslav, KABANOV, Viktor V., LIPOVŠEK, Benjamin, TOPIČ, Marko, MIHAILOVIĆ, Dragan. *Nature Communications.* **15, article no. 4836, 1–7 (2024)**.
https://www.nature.com/articles/s41467-024-49179-z

3) **"Boosting the performance of quantum annealers using machine learning"** BRENCE, Jure, MIHAILOVIĆ, Dragan, KABANOV, Viktor V., TODOROVSKI, Ljupčo, DŽEROSKI, Sašo, **VODEB, Jaka**. *Quantum Machine Intelligence.* **5(1), article no. 4, 1–11 (2023)**. **https://link.springer.com/article/10.1007/s42484-022-00092-y**

4) **"Chiral domain dynamics and transient interferences of mirrored superlattices in nonequilibrium electronic crystals"** RAVNIK, Jan, VASKIVSKYI, Yevhenii, **VODEB, Jaka**, DIEGO, Michele, VENTURINI, Rok, GERASIMENKO, Yaroslav, KABANOV, Viktor V., KRANJEC, Andrej, MIHAILOVIĆ, Dragan. *Scientific Reports.* **13, article no. 19622, 1–9 (2023)**. **https://www.nature.com/articles/s41598-023-46659-y**

5) **"Manipulation of fractionalized charge in the metastable topologically entangled state of a doped Wigner crystal"** MRAZ, Anže, DIEGO, Michele, KRANJEC, Andrej, **VODEB, Jaka**, KARPOV, Peter, GERASIMENKO, Yaroslav, RAVNIK, Jan, VASKIVSKYI, Yevhenii, VENTURINI, Rok, KABANOV, Viktor V., LIPOVŠEK, Benjamin, TOPIČ, Marko, VASKIVSKYI, Igor, MIHAILOVIĆ, Dragan. *Nature Communications.* **14, article no. 8214, 1–8 (2023)**. **https://www.nature.com/articles/s41467-023-43800-3**

6) **"Electronic dislocation dynamics in metastable Wigner crystal states"** KRANJEC, Andrej, KARPOV, Petr, VASKIVSKYI, Yevhenii, **VODEB, Jaka**, GERASIMENKO, Yaroslav, MIHAILOVIĆ, Dragan. *Symmetry.* **14(5), 1–10 (2022)**. **https://www.mdpi.com/2073-8994/14/5/926**

7) **"A time-domain phase diagram of metastable states in a charge ordered quantum material"** RAVNIK, Jan, DIEGO, Michele, GERASIMENKO, Yaroslav, VASKIVSKYI, Yevhenii, VASKIVSKYI, Igor, MERTELJ, Tomaž, **VODEB, Jaka**, MIHAILOVIĆ, Dragan. *Nature Communications.* **12, 2323-1-2323-8 (2021)**.
https://www.nature.com/articles/s41467-021-22646-7

8) **"Quantum billiards with correlated electrons confined in triangular transition metal dichalcogenide monolayer nanostructures"** RAVNIK, Jan, VASKIVSKYI, Yevhenii, **VODEB, Jaka**, AUPIČ, Polona, VASKIVSKYI, Igor, GOLEŽ, Denis, GERASIMENKO, Yaroslav, KABANOV, Viktor V., MIHAILOVIĆ, Dragan. *Nature Communications.* **12(1), 3793-1-3793-8 (2021)**.
https://www.nature.com/articles/s41467-021-24073-0

9) **"Configurational electronic states in layered transition metal dichalcogenides" VODEB, Jaka**, KABANOV, Viktor V., GERASIMENKO, Yaroslav, VENTURINI, Rok, RAVNIK, Jan, VAN MIDDEN, Marion, ZUPANIČ, Erik, ŠUTAR, Petra, MIHAILOVIĆ, Dragan. *New Journal of Physics.* **21, 083001-1-083001-15 (2019)**.
https://iopscience.iop.org/article/10.1088/1367-2630/ab3057

10) **"Quantum jamming transition to a correlated electron glass in 1T-TaS_2"** GERASIMENKO, Yaroslav, VASKIVSKYI, Igor, LITSKEVICH, Maksim, RAVNIK, Jan, **VODEB, Jaka**, DIEGO, Michele, KABANOV, Viktor V., MIHAILOVIĆ, Dragan. *Nature Materials.* **18(10), 1078–1083 (2019)**.
https://www.nature.com/articles/s41563-019-0423-3

11) **"Strain-induced metastable topological networks in laser-fabricated TaS_2 polytype heterostructures for nanoscale devices"** RAVNIK, Jan, VASKIVSKYI, Igor, GERASIMENKO, Yaroslav, DIEGO, Michele, **VODEB,**

Jaka, KABANOV, Viktor V., MIHAILOVIĆ, Dragan. *ACS Applied Nano Materials.* **2(6), 3743–3751 (2019)**. https://pubs.acs.org/doi/10.1021/acsanm.9b00644

12) **"Theoretical modeling of the non-equilibrium amorphous state in 1T-TaS_2" VODEB, Jaka**, KABANOV, Viktor V., GERASIMENKO, Yaroslav, VASKIVSKYI, Igor, RAVNIK, Jan, MIHAILOVIĆ, Dragan. *Journal of Superconductivity and Novel Magnetism.* **32, 3057–3063 (2019)**. https://link.springer.com/article/10.1007/s10948-019-5028-1

ANNEX 2 – List of Conferences

- Qubits 2026, January 26-28, 2026, Boca Raton, Florida, USA (Invited talk)
- NQW, Nonequilibrium Quantum Workshop, December 14-18, 2025, Krvavec, Slovenia (Invited contribution)
- QSim2025, August 4-8, 2025, New York, USA (Poster presentation)
- QuantuMatter2025, May 19-23, 2025, Grenoble, France (Plenary contribution)
- NQW, Nonequilibrium Quantum Workshop, December 15-19, 2024, Krvavec, Slovenia (Invited contribution)
- Telluride Science and Innovation Centre Workshop: Scientific Applications of Quantum Annealers and Simulators, 14-18 October 2024, Telluride, CO, USA (Invited Oral)
- QSim2024, August 12-16, 2024, Rhode Island, USA (Poster)
- NQW, Nonequilibrium Quantum Workshop, December 10-14, 2023, Krvavec, Slovenia (Invited contribution)
- Adiabatic quantum computing 2023, June 19-23, 2023, Albuquerque, New Mexico, USA (Contributed talk, awarded the AQC 2023 Junior Scientist Scholarship)
- Open quantum systems and mesoscopic physics summer school, June 4-9, 2023, Hyytiälä, Finland (Poster)
- Defects in 2D materials, Wilhelm und Else Heraeus-Stiftung, May 7-12,2023, Bad Honnef, Germany (Poster)
- 12th conference of basic research in physics, November 11, 2022, Terme Čatež, Slovenia (Poster)
- APS March Meeting 2022, March 14-18, 2022, Chicago, USA (Oral)
- NQW, Nonequilibrium Quantum Workshop, December 16-22, 2021, Krvavec, Slovenia (Invited contribution)
- QUANTUMatter 2022, June 21-23, 2022, Barcelona, Spain (Poster)
- Quantum 2021, Computation, Materials & Technologies, November 23-25, Bilbao, Spain (Oral)
- Nonequilibrium dynamics and ergodicity of complex quantum systems, December 14-17, 2020, Ambrož, Krvavec, Slovenia (Oral)
- Qubits 2020, September 28-30, 2020, virtual (Oral)
- Gordon Research Conference on Ultrafast Phenomena in Cooperative Systems, February 2-7, 2020, Castelvecchio Pascoli, Italy (Poster)
- Nonequilibrium dynamics in correlated systems and quantum materials, December 15-18, 2019, Ambrož, Krvavec, Slovenia (Oral)
- International Meeting on Study of Matter at Extreme Conditions, SMEC 2019, March 30-April 6, 2019, Miami, USA (Oral, award for best student talk)
- ICSM2018, 6th International Conference on Superconductivity and Magnetism, April 29-May 4, 2018, Antalya, Turkey (Oral)
- Nonequilibrium quantum dynamics and relaxation phenomena in many body systems, December 16th-19th, Ambrož, Krvavec, Slovenia, 2018 (Oral)
- 11th conference of basic research in physics, November 23, 2018, Dobrna, Slovenia (Poster)
- Nonequilibrium phenomena in quantum systems, December 17-20, 2017, Ambrož, Krvavec, Slovenia (Poster)