Dominik Dold, Dr. rer. nat.

Research interests: Energy-efficient AI, Neuromorphic Computing, Theoretical Foundations of Deep Learning, Graph-based Machine Learning, Neuroscience, Explainable AI, AI for Space Applications

Webpage: `https://dodo47.github.io/`

Languages: German (native), English (fluent), French (beginner)

Citizenship: German

Positions

2024 – .... **Marie Curie Research Fellow**. Faculty of Mathematics, University of Vienna.
- Research on mathematical foundations of spiking neural networks, memristor-based AI accelerators for onboard AI, and explainable quantum machine learning.
- Associate editor for Springer Astrodynamics and expert panelist for EPSRC grant.
- Co-organiser of IAA-SPAICE 2025 and ESA SPAICE 2026 conferences.

2021 – 2024 **Internal Research Fellow in AI**. ESA, Advanced Concepts Team, Noordwijk.
- Led research on biologically-inspired AI for space applications and graph-based machine learning for inverse materials design and self-optimising structures.
- Co-founded and organised an international AI conference with 200+ participants.
- Supervised 2 interns, 1 postgraduate, and 1 PhD candidate; work resulted in 4 articles.

2020 – 2021 **AI Residency Researcher**. Siemens AI Lab & Siemens Technology, Munich.
- Developed graph-based machine learning algorithms for explainable anomaly detection.
- Supervised 1 Master's thesis, resulting in 2 articles.
- Inventor on 1 granted and 13 pending international patents.

Education

2016 – 2020 **Dr. rer. nat. (magna cum laude)**. Heidelberg University, Germany.
- Thesis: *Harnessing function from form: towards bio-inspired AI in neuronal substrates*.
- Advisors: Mihai A. Petrovici, Walter Senn, Karlheinz Meier, Andreas Mielke.
- Research stay at University of Bern, Computational Neuroscience Group (Senn).

2014 – 2016 **M.Sc. in Physics**. Heidelberg University, Germany.
- Thesis: *Stochastic Computation in Spiking Neural Networks Without Noise*.

2010 – 2014 **B.Sc. in Physics**. Heidelberg University, Germany.
- Thesis: *Energy Conservation in Fano Spectral Line Shape Control*.

Awards & honors

2025 Invited to write a *Brennpunkt* article for the magazine *Physik Journal* (DPG).

Invited to write a *Viewpoint* article for the magazine *Physics* (Physical Review, APS).

2024 Dagstuhl Seminar invitation.
- Seminar 25291: *(Actual) Neurosymbolic AI: Combining Deep Learning and Knowledge Graphs*.

2023 **Marie Skłodowska-Curie Actions Fellowship**.
- *Biologically-inspired Autonomous Systems for Space Exploration*.

2021 **European Space Agency Research Fellowship**.
- *Energy efficient and explainable learning systems for space missions*.

2019 First prize: International Collegiate Competition for Brain-Inspired Computing.
- Organised and hosted by Tsinghua University, Beijing.

Neuro-inspired Computation Course invitation.
- Organised by the International Research Center for Neurointelligence, Tokyo.

Research funding

2023	Marie Skłodowska-Curie Actions Fellowship (101103062):	200.000€
	ESA Internal Founder Program *Gravity Assist*:	30.000€
2022	ESA OSIP Co-Funded Project (4000140774):	90.000€

Patents

Granted

2024 Method and system for anomaly detection in a network, EP4270227.

Published application

2023 Method and system for anomaly detection in a network.
- USA: US20230353584A1, China: CN116980321A.

2022 Method and Device for Providing a Recommender System.
- Europe: EP4231199A1, WIPO: WO2023160947A1.

2021 Industrial device and method for building and/or processing a knowledge graph.
- Europe: EP4030351A1, USA: US20220229400A1, China: CN114819049A.

Neuromorphic hardware for processing a knowledge graph represented by observed triple statements and method for training a learning component.
- Europe: EP4030349A1, USA: US20220230056A1, China: CN114819048A.

Neuromorphic hardware and method for storing and/or processing a knowledge graph.
- Europe: EP4030350A1, USA: US20220237441A1, China: CN114819047A.

Commissions of trust & public service

Expert panel and reviewer duties

2024 – 2025 **Expert Panel, Reviewer**, UK Engineering and Physical Sciences Research Council.

2024 – .... **Reviewer**, Nature npj Microgravity.

2023 **Program Committee**, International Joint Conference on Neural Networks.

2022 – .... **Reviewer**, Physical Review Research.

2021 **Reviewer**, International Conference on Artificial Neural Networks (ICANN).

Editorial duties

2024 – .... **Associate Editor**, Springer Astrodynamics.
- Special issue *spAIce 2024: One small step for AI in and for space*.

2024 **Editor**.
- Proceedings of SPAICE 2024: the First Conference on AI in and for Space.
- DOI: 10.5281/zenodo.13889941

Conference and event organisation

Co-organiser, GECCO 2024 Space Optimisation Competition (SpOC).

2023 – .... **Co-founder** and **chair of the scientific committee**, ESA's SPAICE conference.
- Managing website, social media, call for papers, submissions, reviews, keynote invites, program assembly, and proceedings. The first edition was a success with over 150 submitted papers, 200 participants, and renowned speakers like Jürgen Schmidhuber.

Scientific Committee, Italian Association of Aeronautics and Astronautics.

2023 **Chair**, AI Application Session, AIDAA XXVII International Congress.

Commissions of trust & public service (continued)

Co-organiser, GECCO 2023 Space Optimisation Competition (SpOC).

2021 **Chair**, Graph Based Methods Session, International Conference for Machine Learning and Applications.

Institutional responsibilities

2024 – 2025 **Organiser**, Math of Machine Learning & Data Science Seminar, Univ. of Vienna.

2021 – 2023 **Organiser**, Advanced Concepts Team's Science Coffee, ESA.
- Managed inviting and hosting internationally renowned researchers.

2018 – 2020 **Organiser**, Electronic Vision(s) Journal Club, University of Heidelberg.

Teaching & mentoring

University lectures

2025 Lecturer, Mathematics of Data Science (Master's in Data Science), University of Vienna.

2018 Teaching assistant, Brain-Inspired Computing, Heidelberg University.

2015 Teacher, Medicine Beginner's Courses in Physics and Mathematics, Heidelberg University.

Seminars and guest lectures

2025 PhD Training Series, RICAM, Linz, Austria.
- *How I (and soon maybe you?) got a Marie Curie Fellowship*.

2023 Guest lecture, UCL AI Society, University College London, UK.
- *Gazing into the future – From graphs, gradients and spiking neurons to space*.

2022 PhD seminar, Observatory of the University of Vienna, Vienna, Austria.
- *Two Ways to ESA Fellowships*.

Supervision experience

Supervision of postgraduate researchers

2023 – .... Zacharia A. Rudge
- PhD student, TU Delft, co-funded via ESA's OSIP. 1 paper published, 1 under review.

2022 – 2023 Amy Thomas
- Project mentor during her Young Graduate Trainee position at ESA. 2 papers published.

Supervision of graduate students

2024 Nadezhda Dobreva
- Title: *Design of Decentralised Control of Self-Configuring Ensembles*.
- Internship, ESA ESTEC. 1 paper under review.

2023 India Walford
- Title: *Novel Neural Network Architectures for Spacecraft Autonomy*.
- Internship & Master's thesis, ESA ESTEC & University College London.

2021 Victor Caceres Chian
- Title: *Towards the integration of graph neural networks into neuromorphic architectures*.
- Master's thesis, Technical University Munich. 2 papers published.

2018 Maximilian Zenk
- Title: *Spatio-temporal predictions with spiking neural networks*.
- Master's thesis, Heidelberg University.

Selected talks

Invited talks

2025 SEA-CROGS Webinar, Pacific Northwest National Laboratory, USA.
- *Causal pieces: analysing and improving spiking neural networks piece by piece*.

2024 Alan Turing Institute AI UK Fringe Events, Loughborough University, UK.
- *Neuromorphic artificial intelligence in space and beyond*.

2022 MAFEX Gründungscamp AI-Day, University of Marburg, Germany.
- *Getting from there to here – Wie durch KI die Raumschiffe von morgen aussehen könnten*.

Conference talks

2023 German Aerospace Congress, Stuttgart, Germany.
- *Modelling the European Space Sector with Knowledge Graphs*.

2022 International Conference on Neuromorphic Systems (ICONS), USA.
- *Neuro-symbolic computing with spiking neural networks*.

IEEE World Congress on Computational Intelligence (WCCI, IJCNN), Padua, Italy.
- *Relational representation learning with spike trains*.

2021 International Joint Conference on Neural Networks (IJCNN), virtual.
- *SpikE: spike-based embeddings for multi-relational graph data*.

2019 Computational and Systems Neuroscience (COSYNE) Conference, Lisbon, Portugal.
- *Lagrangian dynamics of dendritic microcircuits enables real-time backpropagation of errors*.

Workshop talks

2025 The Spiking Neural Networks (SNN) Worshop, LMU Munich.
- *Causal pieces: analysing and improving spiking neural networks piece by piece*.

2021 Spiking neural networks as universal function approximators (SNUFA), virtual.
- *Spike-based embeddings for multi-relational graph data*.