Desmond Kabus

Personal Data

pronunciation: /dɛzmənd kaːbʊs/ 'DEZ-mint KAH-boos'

date and place of birth: 29 December 1994, Bochum, Germany

citizenship: German

civil status: single

Education

since 02/2021: joint PhD in Mathematics of Cardiac Arrhythmias

- *KU Leuven campus Kortrijk*, Belgium:
  group: HeartKOR, Mathematics of Cardiac Arrhythmias, Prof. Hans Dierckx
- *Leids Universitair Medisch Centrum*, Leiden, the Netherlands:
  group: Laboratory of Experimental Cardiology, Prof. Daniël Pijnappels

  keywords: cardiology, computational physics, optimisation, machine learning, tissue models, optical voltage mapping, data-driven, human immortalised atrial myocytes (hiAM)

06/2022: *L'institut des maladies du rythme cardiaque* (LIRYC), *Université de Bordeaux*, France
summer school in Cardiac Electrophysiology

10/2016 – 09/2019: *Ruhr-Universität Bochum*, Germany
Master of Science in Physics with distinction (overall grade 1.0)
major: plasma physics, minor: computational physics, machine learning

keywords: cardiology, bi- and mono-domain description of muscle tissue, computational physics, optimisation, machine learning, solution of inverse problems, adjoint state method, finite differences

institute: Theoretical Physics I (Computational Plasma Physics), Prof. Dr. Rainer Grauer

08/2015 – 01/2016: *Stockholms Universitet*, Sweden
semester abroad in Sweden funded by an ERASMUS grant

10/2013 – 09/2016: *Ruhr-Universität Bochum*, Germany
Bachelor of Science in Physics (overall grade 1.8)

institute: Theoretical Physics I (Computational Plasma Physics), Dr. Jürgen Dreher

keywords: cardiology, bi- and mono-domain description of muscle tissue, computational physics, finite differences, methods for enforcement of boundary conditions

2013: *Landfermann-Gymnasium Duisburg*, Germany
Allgemeine Hochschulreife (Abitur) – general qualification for university entrance (overall grade 1.2)

Publications

1. **Kabus, D.**, Arno, L., Leenknegt, L., Panfilov, A. V., & Dierckx, H. (2022). Numerical methods for the detection of phase defect structures in excitable media. *PLOS ONE*, *17*(7), 1–31. https://doi.org/10.1371/journal.pone.0271351
2. Cloet, M., Arno, L., **Kabus, D.**, Van der Veken, J., Panfilov, A. V., & Dierckx, H. (2023). Scroll waves and filaments in excitable media of higher spatial dimension. *Physical Review Letters*, *131*(20), 208401. https://doi.org/10.1103/PhysRevLett.131.208401
3. **Kabus, D.**, De Coster, T., de Vries, A. A. F., Pijnappels, D. A., & Dierckx, H. (2024). Fast creation of data-driven low-order predictive cardiac tissue excitation models from recorded activation patterns. *Computers in Biology and Medicine*, *169*, 107949. https://doi.org/10.1016/j.compbiomed.2024.107949
4. **Kabus, D.**, Cloet, M., Zemlin, C., Bernus, O., & Dierckx, H. (2024). The Ithildin library for efficient numerical solution of anisotropic reaction-diffusion problems in excitable media. *PLOS ONE*, *19*(9), 1–26. https://doi.org/10.1371/journal.pone.0303674
5. Legat, T., Grachev, V., **Kabus, D.**, Lettinga, M. P., Clays, K., Verbiest, T., de Coene, Y., Thielemans, W., & Van Cleuvenbergen, S. (2024). Imaging with a twist: Three-dimensional insights of the chiral nematic phase of cellulose nanocrystals via SHG microscopy. *Science Advances*, *10*(44), eadp2384. https://doi.org/10.1126/sciadv.adp2384
6. Arno, L., **Kabus, D.**, & Dierckx, H. (2024). Analysis of complex excitation patterns using Feynman-like diagrams. *Scientific Reports*, *14*(1), 28962. https://doi.org/10.1038/s41598-024-73544-z

Forthcoming

1. Arno, L., **Kabus, D.**, & Dierckx, H. (2024). Strings, branes and twistons: Topological analysis of phase defects in excitable media such as the heart. In *arXiv preprint arXiv:2401.02571*. https://doi.org/10.48550/arXiv.2401.02571
2. De Coster, T., **Kabus, D.**, Verkerk, A. O., Veldkamp, M. W., Harlaar, N., Dekker, S. O., Vries, A. A. F. de, Pijnappels, D. A., & Panfilov, A. V. (2025). *Ionic mechanisms underlying human immortalised atrial action potential properties: Insights from a mathematical model*.
3. Gobeyn, A., **Kabus, D.**, & Dierckx, H. (2025). *ZEUS method for the numerical detection of topological quasi-particles arising in the context of excitable media*.
4. Leenknegt, L., Omara, S., Cloet, M., **Kabus, D.**, Zeppenfeld, K., Panfilov, A. V., & Dierckx, H. (2025). *The EGM generated by an oblique wave front and its application in solving the inverse problem*.
5. Kamphuis, J. M., **Kabus, D.**, Bonnet, S., Hupkes, H. J., & De Coster, T. (2025). *Noise slows down spiral waves in excitable media: Numerically and experimentally validated analytical predictions*.
6. **Kabus, D.**, Dierckx, H., & De Coster, T. (2025). *Pigreads: Python-integrated GPU-enabled reaction diffusion solver using OpenCL and Pybind11 for cardiac electrophysiology and other applications*.

Theses

1. **Kabus, D.** (2016). *Comparison of phase field and interpolation methods for the representation of geometries in the numerical analysis of reaction-diffusion systems* [Bachelor's thesis, Ruhr-Universität Bochum]. https://hbz-ubo.primo.exlibrisgroup.com/permalink/49HBZ_UBO/mnkbqv/alma991012283309706471
2. **Kabus, D.** (2019). *Analysis of parametric level set functions for the representation of geometry in the optimal control of reaction-diffusion systems* [Master's thesis, Ruhr-Universität Bochum]. https://hbz-ubo.primo.exlibrisgroup.com/permalink/49HBZ_UBO/mnkbqv/alma991018264849706471

Conference contributions

1. **Kabus, D.**, Arno, L., Leenknegt, L., Harlaar, N., Dekker, S. O., Panfilov, A. V., De Vries, A. A. F., Pijnappels, D. A., & Dierckx, H. (2022). Centres of spiral waves can be detected as phase defect lines in optical voltage mapping data and numerical simulations. *Conference of the European Heart Rhythm Association (EHRA)*. https://esc365.escardio.org/presentation/247532
2. **Kabus, D.**, Harlaar, N., Dekker, S. O., de Vries, A. A. F., Pijnappels, D. A., & Dierckx, H. (2023). Creation of predictive cardiac excitation models at the tissue scale with machine learning in augmented state space. *SIAM Conference on Applications of Dynamical Systems (DS23)*. https://meetings.siam.org/sess/dsp_talk.cfm?p=127148
3. **Kabus, D.**, Dierckx, H., & De Coster, T. (2025). Accelerated simulation of cardiac tissue using data-driven models. *Conference on Mathematics of Wave Phenomena 2025*. https://conference25.waves.kit.edu/wp-content/uploads/2025/02/BoA.pdf

Teaching Experience

since 2019: *Segelsport-Interessentengemeinschaft an der Ruhr-Universität Bochum*, Germany
sailing instructor for internal waters

10/2021 – 06/2024: *KU Leuven campus Kortrijk*, Belgium
supervision of two master thesis projects in applied mathematics to cardiology

11/2021 – 01/2024: *KU Leuven campus Kortrijk*, Belgium
tutor for the lecture *Partial Differential Equations*

10/2021 – 02/2022: *KU Leuven campus Kortrijk*, Belgium
supervision of two bachelor thesis projects in collaboration with *Digital Arts and Entertainment* at *Howest*

11/2021 – 01/2022: *KU Leuven campus Kortrijk*, Belgium
project manager for the engineering course *Problem Solving and Development*

04/2019 – 08/2019: *Ruhr-Universität Bochum*, Germany
tutor for the lecture *Theoretical Mechanics*

04/2016 – 08/2016: *Ruhr-Universität Bochum*, Germany
manager of an experimental project of physics students

04/2016 – 08/2016: *Ruhr-Universität Bochum*, Germany
instructor for a physics lab course for geoscientists

04/2015 – 08/2015: *Ruhr-Universität Bochum*, Germany
tutor for the lecture *Electromagnetism and Optics*

10/2014 – 02/2015: *Ruhr-Universität Bochum*, Germany
tutor for the lecture *Physics for Biologists II*

10/2014 – 02/2015: *Ruhr-Universität Bochum*, Germany
tutor for the lecture *Mechanics and Thermodynamics*

Work Experience

01/2020 – 02/2020: *Talley's Blenheim*, New Zealand
aquacultural work

10/2019 – 12/2019: *Far North Blueberries*, New Zealand
agricultural work

03/2017 – 04/2018: *Nachhilfe-Kolleg Bochum-Linden*, Germany
private tutor in mathematics and physics

10/2012 - 11/2012: *mse Software GmbH Hattingen*, Germany
student internship at a technology company

07/2011: *Kosmos-Apotheke Bochum*, Germany
student internship at a pharmacy

Cultural Experience

09/2019 – 04/2020: *working holiday* in New Zealand
exchange of culture and language

11/2010, 03/2011: *Russell High School*, Kansas, USA
exchange of culture and language with a school in the US state of Kansas

Languages

German: native speaker

English: proficient in speech and writing (reference level C2 in accordance with CEFR)

Dutch: intermediate knowledge (reference level B1 in accordance with CEFR)

Swedish: elementary knowledge

Latin: proficiency certificate awarded in 07/2010

Classical Greek: proficiency certificate awarded in 07/2012

Technical Skills

programming languages:

- proficient: `C`, `C++`, `Python`, `Myokit`, `Lua`, `LaTeX`, `(ba)sh`, `HTML`, `CSS`, `JavaScript`
- basic skills: `Rust`, `C#`, `Matlab`, `Haskell`, `Java`

software: GNU/Linux, Git, OpenMP, ParaView, iRODS, Windows, Office

Hobbies

video game design, hiking, sailing, kayaking, rowing, travelling

Leiden, 18 April 2025