Dennis Wörthmüller

Curriculum Vitae

Mannheim, 68167, Germany
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Research interests

finite element methods, continuum mechanics, cell mechanics, optogenetics, numerics of partial differential equations, stochastic and non-linear dynamics, coarse grained Brownian dynamics simulations, reaction-diffusion systems, protein assembly

Education

2018 – 2022 **PhD in physics**, *Ruprecht-Karls-Universität Heidelberg*, Germany
Specialization: Theoretical biophysics (cell mechanics, optogenetics)

2015 – 2018 **Master of science in physics**, *Ruprecht-Karls-Universität Heidelberg*, Germany
Specialization: Theoretical biophysics (Brownian dynamics of protein self-assembly)

2012 – 2015 **Bachelor of science in physics**, *Ruprecht-Karls-Universität Heidelberg*, Germany
Specialization: Experimental particle physics (Bunch-crossing identification for ATLAS at the Large Hadron Collider (LHC, CERN))

Publications and Preprints

Publications

Tomas Andersen*, Dennis Wörthmüller*, Dimitri Probst, Irène Wang, Philippe Moreau, V Fitzpatrick, Thomas Boudou, Ulrich S. Schwarz, Martial Balland
Cell size and actin architecture determine force generation in optogenetically activated cells
PDF
https://doi.org/10.1016/j.bpj.2023.01.011

Santiago Gomez Melo*, Dennis Wörthmüller*, Pierre Gönczy, Niccolo Banterle and Ulrich S. Schwarz
Grand canonical Brownian dynamics simulations of adsorption and self-assembly of SAS-6 rings on a surface
PDF
https://doi.org/10.1063/5.0135349

Preprints

Artur Ruppel*, Dennis Wörthmüller*, Vladimir Misiak, Manasi Kelkar, Irène Wang, Philippe Moreau, Adrien Méry, Jean Révilloud, Guillaume Charras, Giovanni Cappello, Thomas Boudou, Ulrich S. Schwarz, Martial Balland
Force propagation between epithelial cells depends on active coupling and mechano-structural polarization
https://doi.org/10.1101/2022.06.01.494332

(*These authors contributed equally.)

Research experience

2018-2022 **PhD student**, *Institute for theoretical physics* , Heidelberg University, Germany
Research Advisors: Prof. Ulrich Schwarz and Dr. Falko Ziebert
Project: Finite Element Modeling of Optogenetic Control of Cell Contractility
- Developed research questions in collaboration with experimentalists to study force generation and force propagation in adherent adherent cells
- Developed and extended finite element approaches to simulate adherent cells as active elastic materials
- Analyzed experimental data and performed basic image processing
- Implemented discontinuous Galerkin methods to study interacting cell systems

2015-2018 **MSc student**, *Institute for theoretical physics* , Heidelberg University, Germany
Research Advisors: Prof. Ulrich Schwarz and Dr. Felix Frey
Project: Computer Simulations of SAS-6 Self-Assembly in Two Dimensions
- Developed research questions to study the self-assembly properties of SAS-6 proteins with focus on malformed structures
- Developed and implemented a force-based Brownian dynamics patchy particles simulation in two dimensions
- Implemented a rare-event (forward flux sampling) to quantify protein dissociation rates
- Conducted a statistical analysis of the simulation results

2012-2015 **BSc student**, *Kirchhoff institute for physics*, Heidelberg University, Germany
Research Advisors: Prof. Hans-Christian Schultz-Coulon, Dr. Rainer Stamen and Dr. Jan Jongmanns
Project: Kalibration eines verbesserten Algorithmus zur Identifikation der Strahlkreuzung saturierter Signale für den ATLAS Level-1 Kalorimeter-Trigger
- Analysed oscilloscope pulses to calibrate an algorithm used for Bunch-crossing identification of saturated signals in the PreProcessor of the ATLAS Level-1 Calorimeter Trigger at the Large Hadron Collider (LHC, CERN)

Conferences, Workshops, Talks and Posters

09/2022 **European Conference on Mathematical and Theoretical Biology**, *Heidelberg*, Germany
- Invited speaker at minisymposium on "Bridging scales between the cytoskeleton and tissue mechanics"
- Talk: Modeling optogenetic control of cell contractility and force propagation in epithelial tissue.

09/2019 **IWR School 2019, A Crash Course in Machine Learning with Applications in Natural- and Life Sciences** , *Heidelberg*, Germany

04/2019 **DPG Spring Meeting of the Condensed Matter Section (SKM)**, *Regensburg*, Germany
- Poster title: *Computer Simulations of SAS-6 Assembly on Surfaces*

03/2018 **DPG Spring Meeting of the Condensed Matter Section (SKM)**, *Berlin*, Germany

03/2018 **IFF Spring School: "Physics of Life"**, *Jülich*, Germany

Teaching and mentoring experience

Oct 2022 - Mar 2023 **Teaching assistant**, *Heidelberg University*, *Theoretical physics V,* **Statistical Physics**, Instructor: Prof. Ulrich Schwarz, Heidelberg University
- Conducted tutorial sessions (ca. 90min) on different topics of theoretical statistical physics
- Corrected and evaluated assignments of ca. 10-20 people

Dec 2020 - Dec 2021 **Mentor for master's student**, *Heidelberg University*,
Instructor: Prof. Ulrich Schwarz
Student: Santiago Gomez Melo
Project: Grand Canonical Brownian Dynamics of SAS-6 Self-Assembly
- Introduced the student to my custom written simulation software.
- Assisted in solving problems related to the programming
- Supported the student in the development of a research question

Oct 2020 - Mar 2021 **Teaching assistant**, *Heidelberg University*, *Theoretical physics V,* **Statistical Physics**,
Instructor: Prof. Ulrich Schwarz, Heidelberg University
- Conducted online tutorial sessions (ca. 90min) on different topics of theoretical statistical physics
- Corrected and evaluated assignments of ca. 10-20 people

Oct 2019 - Mar 2020 **Teaching assistant**, *Heidelberg University*, *Theoretical physics III,* **Classical electrodynamics**,
Instructor: Prof. Ulrich Schwarz, Heidelberg University
- Conducted tutorial sessions (ca. 90min) on different topics of classical electrodynamics
- Corrected and evaluated assignments of ca. 10-20 people

Oct 2018 - Mar 2019 **Teaching assistant**, *Heidelberg University*, **Continuum mechanics**,
Instructor: Prof. Ulrich Schwarz, Heidelberg University
- Created exercises for weekly problem sheets
- Conducted tutorial sessions (ca. 90min) on different topics of continuum mechanics
- Corrected and evaluated assignments of ca. 10-20 people

Oct 2017 - Mar 2018 **Teaching assistant**, *Heidelberg University*, *Theoretical physics I,* **Classical mechanics and mathematical methods**,
Instructor: Prof. Luca Amendola, Heidelberg University
- Conducted tutorial sessions (ca. 90min) on different topics of classical mechanics and fundamental mathematical concepts
- Corrected and evaluated assignments of ca. 10-20 people

Apr - Oct 2017 **Teaching assistant**, *Heidelberg University*, *Theoretical physics IV,* **Quantum mechanics**,
Instructor: Prof. Matthias Bartelmann, Heidelberg University
- Conducted tutorial sessions (ca. 90min) on different topics of quantum mechanics
- Corrected and evaluated assignments of ca. 10-20 people

Oct 2016- Mar 2017 **Teaching assistant**, *Heidelberg University*, *Theoretical physics III,* **Classical electrodynamics**,
Instructor: Prof. Carlo Ewerz, Heidelberg University
- Conducted tutorial sessions (ca. 90min) on different topics of classical electrodynamics
- Corrected and evaluated assignments of ca. 10-20 people

2014,2015 **Teaching assistant**, *Ruprecht-Karls-Universität Heidelberg*, *Teaching for the beginner's physics labs*,
Instructor: Dr. Jens Wagner, Heidelberg University
- Assisted students in learning physical measurement techniques and data evaluation of experiments.
- Corrected and evaluated lab protocols

Additional skills

programming *Python 3*, *C++*, *R*, *MATLAB*

Languages German (native), english (fluent)

References

Prof. Dr. Ulrich Schwarz, Institute for theoretical physics, Heidelberg University
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Dr. Falko Ziebert, Institute for theoretical physics, Heidelberg University
f.ziebert@thphys.uni-heidelberg.de

Prof. Dr. Martial Balland, Laboratoire Interdisciplinaire de Physique, Grenobles Alpes
Martial.Balland@univ-grenoble-alpes.fr

Prof. Dr. Frauke Gräter, Heidelberg institute for theoretical studies
frauke.graeter@h-its.org