Dr. Dennis Wörthmüller

Curriculum Vitae

Institut Curie, Physics of Cells and Cancer (UMR168), 11 Rue Pierre et Marie Curie, 75005 Paris, France
dennis.worthmuller [at] curie.fr
https://dworthmuller.github.io

Research Interests

Membrane Physics — Interactions between actin cytoskeleton and cell membranes during cell migration and protrusion formation, actin-driven instabilities, shape instabilities of flowing lipid bilayers

Mechanics of Adherent Cells — Active gel models for adherent cells, role of actin architecture in force generation and force propagation, cell-cell interactions, optogenetics

General Interests — numerical treatment of partial differential equations i.e. the finite element method (FEM), stochastic and non-linear dynamics, reaction-diffusion systems, protein assembly, Brownian dynamics simulations

Professional Experience

June 2023 - present

Postdoctoral Research Associate
Institut Curie (PCC), UMR168 Physics of Cells and Cancer, Sorbonne University, Paris, France
Research Advisors: Prof. Pierre Sens
Project: *Pushing from within: control of cell shape, integrity and motility by cytoskeletal pushing force*
Short project description: Developing analytical and numerical models to investigate how cell-generated pushing forces shape adhesion-independent control of cell morphology, substrate interactions, and motility.

Aug 2022 - Feb 2023

Postdoctoral Research Associate (transition)
Institute for theoretical physics, Heidelberg University, Heidelberg, Germany
Research Advisors: Prof. Ulrich Schwarz

Academic Training

Sept 2018 - July 2022

Ph.D. in Physics (magna cum laude)
Institute for theoretical physics, Heidelberg University, Heidelberg, Germany
Specialization: Theoretical biophysics (cell mechanics, optogenetics)
Research Advisors: Prof. Ulrich Schwarz and Dr. Falko Ziebert
Thesis title: *"Finite Element Modeling of Optogenetic Control of Cell Contractility "*

Oct 2015 - July 2018

M.Sc. in Physics
Institute for theoretical physics, Heidelberg University, Heidelberg, Germany
Specialization: Theoretical biophysics (Brownian dynamics of protein self-assembly)
Research Advisors: Prof. Ulrich Schwarz and Dr. Felix Frey
Thesis title: *"Computer Simulations of SAS-6 Self-Assembly in Two Dimensions"*

Oct 2012 - Aug 2015

B.Sc. in Physics
Kirchhoff institute for physics, Heidelberg University, Heidelberg, Germany
Specialization: Experimental particle physics (Bunch-crossing identification for ATLAS at the Large Hadron Collider (LHC, CERN))
Research Advisors: Prof. Hans-Christian Schultz-Coulon, Dr. Rainer Stamen and Dr. Jan Jongmanns
Thesis title: *" Kalibration eines verbesserten Algorithmus zur Identifikation der Strahlkreuzung saturierter Signale für den ATLAS Level-1 Kalorimeter-Trigger"*

Student Supervision

Dec 2023 - present

Co-supervising PhD student
Institut Curie (PCC), UMR168 Physics of Cells and Cancer, Sorbonne University, Paris, France
Instructor: Prof. Pierre Sens
Student: Kristiana Mihali
Project: Actin-driven membrane instabilities

Dec 2020 - Dec 2021

Supervising master's student
Institute for theoretical physics, Heidelberg University, Heidelberg, Germany
Instructor: Prof. Ulrich Schwarz
Student: Santiago Gomez Melo
Project: Grand Canonical Brownian Dynamics of SAS-6 Self-Assembly, published in Journal of Chemical Physics

Teaching Experience

Oct 2018 - Mar 2019

Lead Teaching Assistant in Theoretical Physics
Heidelberg University, Heidelberg, Germany
Instructor: Prof. Ulrich Schwarz
Course: ***Continuum Mechanics***

Oct 2016 - Mar 2023

Teaching Assistant in Theoretical Physics
Heidelberg University, Heidelberg, Germany
Courses: ***Classical electrodynamics*** (Prof. Carlo Ewerz, Winter 2016/17), ***Quantum Mechanics*** (Prof. Matthias Bartelmann, Summer 2017), ***Classical mechanics and mathematical methods*** (Prof. Luca Amendola, Winter 2017/18), ***Classical electrodynamics*** (Prof. Ulrich Schwarz, Winter 2019/20), ***Statistical Physics*** (Prof. Ulrich Schwarz, Winter 2020/21, 2022/23)

2014 and 2015

Lab Teaching Assistant for the beginner's physics labs
Heidelberg University, Heidelberg, Germany
Instructor: Dr. Jens Wagner
Courses: ***Temperature Measurement, Photoelectric effect***

Publications

Publications

A. Ruppel*, **D. Wörthmüller***, V. Misiak, M. Kelkar, I. Wang, P. Moreau, A. Méry, J. Révilloud, G. Charras, G. Cappello, T. Boudou, U. S. Schwarz, and M. Balland, **Force propagation between epithelial cells depends on active coupling and mechano-structural polarization**, **eLife** 12, e83588 **(2023)**.

T. Andersen*, **D. Wörthmüller***, D. Probst, I. Wang, P. Moreau, V. Fitzpatrick, T. Boudou, U. S. Schwarz, and M. Balland, **Cell size and actin architecture determine force generation in optogenetically activated cells**, **Biophysical Journal** 122, 684 **(2023)**.

S. Gomez Melo*, **D. Wörthmüller***, P. Gönczy, N. Banterle, and U. S. Schwarz, **Grand canonical Brownian dynamics simulations of adsorption and self-assembly of SAS-6 rings on a surface**, **The Journal of Chemical Physics** 158, 085102 **(2023)**.

Preprints

D. Wörthmüller, F. Ziebert, and U. S. Schwarz, **Modelling mechanochemical coupling in optogenetically activated cell layers**, **bioRxiv** 2025.06. 30.662367 **(2025)**

D. Wörthmüller, G. Ferraro, P. Sens, and M. Castellana, **IRENE: a fluid layer finite-element software**, **arXiv** 2506.17827 **(2025)**.

* These authors contributed equally to this work.

Academic Service

Peer-review	**Co-reviewer for Physical Review X (with Prof. Francois Graner)**

Conferences and Talks

May 2025	**Active Matter: the synergy between Maths and Physics**, Institut Poincaré, Paris, France Contribution: *Active Gel on a Wavy Surface, Stresses and Instabilities* **(Poster)**
Oct 2024	**Theory Group Seminar at Institut Curie**, Paris, France Contribution: *Optogenetic control of cell contractility and force propagation in epithelial tissue* **(Talk)**
April 2024	**Morphodynamics of Living Systems**, Grande salle des séances of Institut de France, Paris, France
Nov 2023	**Unraveling the Complexity: Decoding Cellular and Molecular Organization on Engineered Micropatterns and 3D Structures**, Paris, France
Sep 2022	**European Conference on Mathematical and Theoretical Biology**, Heidelberg, Germany Invited speaker at minisymposium on "Bridging scales between the cytoskeleton and tissue mechanics" Contribution: *Modeling optogenetic control of cell contractility and force propagation in epithelial tissue.* **(Invited Talk)**
Sep 2019	**IWR School 2019, A Crash Course in Machine Learning with Applications in Natural- and Life Sciences**, Heidelberg, Germany
April 2019	**DPG Spring Meeting of the Condensed Matter Section (SKM)**, Regensburg, Germany Contribution: *Computer Simulations of SAS-6 Assembly on Surfaces* **(Poster)**
Mar 2018	**DPG Spring Meeting of the Condensed Matter Section (SKM)**, Berlin, Germany **IFF Spring School: "Physics of Life"**, Jülich, Germany

Additional Skills

Programming

Python 3, *C++*, *R*, *MATLAB*, Skilled in using the open-source cytoskeleton simulation suite **Cytosim** and advanced in finite element modeling with **FEniCS**; experienced in high-performance **computing on clusters** for large-scale simulations.

Languages

German (native), english (fluent), French (sufficient reading and comprehension, limited speaking)

References

Prof. Dr. Pierre Sens,
Physics of Cells and Cancer UMR 168, Institut Curie
Postdoctoral Advisor
Email: pierre.sens@curie.fr

Dr. Falko Ziebert,
Institute for theoretical physics, Heidelberg University
PhD Supervisor
Email: f.ziebert@thphys.uni-heidelberg.de

Dr. Michele Castellana,
Physics of Cells and Cancer UMR 168, Institut Curie
Email: michele.castellana@curie.fr

Prof. Dr. Ulrich Schwarz,
Institute for theoretical physics, Heidelberg University
PhD Supervisor
Email: schwarz@thphys.uni-heidelberg.de

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