

Dr. Felix Frey**Personal Details**

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 Website <https://ffffrey.github.io>

**Summary statement**

I am a theoretical physicist by training and I work primarily in the areas of biophysics and soft matter. In particular, I study self-assembly, transport and remodeling processes at fluid lipid membranes with the ambition to develop a physical understanding of living matter. In my work, I use a combination of continuum modeling and particle-based mesoscale computer simulations to bridge scales.

Academic positions

2026 – Assistant Professor in the group of Soft Matter and Biological Physics in the Department of Applied Physics and Science Education at Eindhoven University of Technology (TU/e)
 2022 – 2025 Independent NOMIS Postdoctoral fellow at the Institute of Science and Technology Austria (ISTA) with Anđela Šarić
 2020 – 2022 Postdoc at the Department of Bionanoscience, Kavli Institute of Nanoscience, Delft University of Technology (TU Delft), in the group of Timon Idema
 2019 – 2020 Postdoc at the Institute for Theoretical Physics, Heidelberg University, in the group of Ulrich Schwarz
 2015 – 2019 PhD researcher at the Institute for Theoretical Physics, Heidelberg University, in the group of Ulrich Schwarz

Education

06/2019 PhD at the Institute for Theoretical Physics, Heidelberg University
 Thesis title: *Physical models for uptake processes at the cell membrane*
 Advisor: Ulrich Schwarz.
 07/2015 Master of Science in Physics at Heidelberg University.
 07/2012 Bachelor of Science in Physics at Heidelberg University.
 06/2009 Abitur (A-level) at the Ludwig-Uhland-Gymnasium in Kirchheim unter Teck.

Fellowships and awards

2022 Independent NOMIS fellowship (fully funded independent 3-year Postdoc position, worth 242.000€)
 2022 IST-BRIDGE fellowship (fully funded independent 2-year Postdoc position), funded from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 101034413 (declined)
 2021 Kavli Synergy Grant (worth 50.000€)
 2020 Among the six best dissertations at the Heidelberger Wilhelm-und-Else Heraeus dissertation prize for physics and astronomy
 2018 Travel grant for the Biophysical Society Annual Meeting in San Francisco funded through the Excellence Initiative at Heidelberg University
 2015 Full 3-year PhD fellowship of the Heidelberg Graduate School for Physics (HGSFP)
 2009 School award of the German Physical Society (DPG)

Talks and posters at international conferences and seminars

8 invited talks, 12 contributed talks at international conferences, 7 seminar talks and 17 contributed posters (02/2026)

Invited talks at international conferences and seminars:

- 2024 Invitation for a talk at the *International Symposium on Membrane/Protein Interactions*, University of Chicago International Institute for Research in Paris
- 2024 Invitation for a talk at the *Young Investigator Mini Symposium at the Department of Biology at University of Erlangen-Nuremberg*, Erlangen
- 2023 Invitation for a talk at the symposium *Septins: biology meets physics* at TU Delft, Delft
- 2023 Invitation for a talk at the *DGZ Focus Workshop: Workgroup Membrane Trafficking and Molecular Motors*, online
- 2023 Invitation for a talk at the symposium *Theoretical Physics - Theory of Condensed Matter* at Johannes Gutenberg University, Mainz
- 2023 Invitation for a seminar talk at the *Max-Planck-Institute of Biophysics*, Frankfurt am Main
- 2022 Invitation for a talk at the *Statistical Physics and low dimensional systems conference*, Pont-à-Mousson
- 2019 Invitation for a seminar talk at the *Department of Bionanoscience*, TU Delft

Contributed talks at international conferences:

- 2026 Selected abstract for a talk at the *DPG Spring Meeting*, Dresden
- 2025 Selected abstract for a talk at the *DPG Spring Meeting*, Regensburg
- 2024 Selected abstract for a talk at the *German Biophysical Society Meeting*, Leipzig
- 2024 Selected abstract for a talk at the *DPG Spring Meeting*, Berlin
- 2023 Selected abstract for a talk at the *EMBO | EMBL Symposium Life at the periphery: mechanobiology of the cell surface*, Heidelberg
- 2023 Selected abstract for a talk at the *DPG Spring Meeting*, Dresden
- 2022 Selected abstract for a talk at the *DPG Spring Meeting*, Regensburg
- 2022 Contributed flash talk at *Dutch Soft Matter Meeting*, Delft
- 2022 Selected abstract for a talk at *SynCell2022*, The Hague
- 2021 Selected abstract for a talk at *Dutch Biophysics*, online
- 2019 Selected abstracts for two talks at the *DPG Spring Meeting*, Regensburg
- 2018 Selected abstract for a talk at the *DPG Spring Meeting*, Berlin

Seminar talks:

- 2025 Talk at *Evolunch seminar series*, IST Austria, Klosterneuburg
- 2025 Seminar talk at the Department of Bionanoscience, TU Delft
- 2024 Talk at *Membrane Club seminar series*, Institute of Molecular Biotechnology (IMBA), Vienna
- 2024 Talk at *Soft Hour seminar series*, IST Austria, Klosterneuburg
- 2022 Talk at *Soft Hour seminar series*, IST Austria, Klosterneuburg
- 2022 Talk at the *BN Forum*, seminar of the Department of Bionanoscience, TU Delft (online)
- 2018 Talk at *BioQuant Internal Seminar*, Heidelberg University

Contributed posters at international conferences:

- 2025 Selected abstract for a poster at *The Vienna Soft Matter Day*, University of Natural Resources and Life Sciences, Vienna
- 2024 Selected abstract for a poster at *The Vienna Soft Matter Day*, Technical University of Vienna
- 2024 Selected abstract for a poster at the *EMBO | EMBL Symposium The mechanics of life: from development to disease*, Heidelberg
- 2023 Selected abstract for a poster at the *ISMC 2023 | 7th International Soft Matter Conference*, Osaka
- 2022 Poster at *The Vienna Soft Matter Day*, IST Austria, Klosterneuburg
- 2022 Selected abstract for a poster at the *Biophysical Society Annual Meeting*, San Francisco
- 2022 Selected abstract for a poster at *NWO Physics@Veldhoven*, online

2021	Selected abstract for a <u>poster</u> at <i>Dutch Biophysics</i> , online
2021	Selected abstract for a <u>poster</u> at <i>EMBO Workshop Molecular and Cell Biology of Septins</i> , Berlin
2021	Selected abstract for a <u>poster</u> at <i>EMBO Workshop Physics of living systems: From molecules to tissues</i> , online
2021	Selected abstract for a <u>poster</u> at the <i>BaSyC (Building a Synthetic Cell) Spring Meeting</i> , online
2021	Selected abstract for a <u>poster</u> at the <i>DPG Spring Meeting</i> , online
2019	Selected abstract for a <u>poster</u> at the <i>Biomembrane Days 2019</i> , Berlin
2018	Selected abstract for a <u>poster</u> at the <i>Venice Meeting on Fluctuations in Small Complex Systems IV</i> , Venice
2018	Selected abstract for a <u>poster</u> and <u>flash talk</u> at the <i>BDBDB4 Meeting</i> , Heidelberg
2018	Selected abstract for a <u>poster</u> at the <i>Biophysical Society Annual Meeting</i> , San Francisco
2017	Selected abstract for a <u>poster</u> at the <i>DPG Spring Meeting</i> , Dresden

Teaching experience and supervision

2025, summer	<u>Lecture substitution</u> (two lectures) at IST Austria in Soft Matter Physics (PhD course) for Prof. Anđela Šarić
2019, winter	<u>Exercises</u> in Electrodynamics (BSc course) at Heidelberg University
2019, summer	<u>Lecture substitution</u> (one lecture) at Heidelberg University in Theoretical Biophysics (MSc course) for Prof. Ulrich Schwarz
2016, winter	<u>Exercises</u> in Stochastic Dynamics (MSc course) at Heidelberg University
2016, winter	<u>Exercises</u> in Non-linear Dynamics (MSc course) at Heidelberg University
2016, summer	<u>Exercises</u> in Theoretical Biophysics (MSc course) at Heidelberg University
2015, winter	<u>Exercises</u> in Theoretical Statistical Physics (MSc course) at Heidelberg University
2022	<u>Co-supervision of two Bachelor End Projects at TU Delft</u> (Leó Szücs, <i>Modeling and analysis of cytoskeletal septin filament growth</i> and Léo Simon, <i>Modeling of spherical virus particle motion and uptake at the cell membrane</i>)
2018	<u>Co-supervision of one Master thesis at Heidelberg University</u> (Dennis Wörthmüller, <i>Computer simulations of SAS-6 self-assembly in two dimensions</i>)
2016-2018	<u>Co-supervision of three Bachelor theses at Heidelberg University</u> (David Outland, <i>Computer simulations of growing clusters</i> ; Vanessa Scheller, <i>Modeling polymers as random walks</i> and Markus Miltner, <i>Computer simulations of cluster growth</i>)

Reviewing activities

Physical Review Letters (APS), PRX Life (APS), Physical Review Research (APS), Physical Review E (APS), New Journal of Physics (IOPscience), The Journal of Applied Physics, The Journal of Chemical Physics, The Proceedings of the National Academy of Sciences (PNAS), eLife, Biology of the Cell, Nature Cell Biology, Nature Communications

Administration and organization

2022	<u>Organization of the theory journal club</u> of the Department of Bionanoscience at TU Delft
2022	<u>Co-organization of the scientific retreat</u> for the theory division of the Department of Bionanoscience at TU Delft involving the groups of three principal investigators
2021	<u>Participation at the EMBO Lab Leadership course</u> for postdocs (online)

List of publications

Summary of bibliometric information (Google Scholar, 02/2026): 526 citations, h-index: 11

In preparation

19. G. Castro Linares*, **F. Frey***, D. de Ridder*, S. Reese, M. Mavrikakis, R. P. Richter, T. Idema, and G. H. Koenderink, *Human septin binding and polymerization on lipid membranes depends on oligomer species, lipid composition and GTP*, **in preparation** (2026). *Equal contributions.

Submitted:

18. **F. Frey**, M. Amaral, A. Šarić, *Cracking donuts and sorting lipids: geometry controls archaeal membrane stability and lipid organization*, **submitted** (2026).
17. L. Baldauf, **F. Frey**, M. Arribas Perez, M. Vladenov, M. Way, T. Idema, G. H. Koenderink, *Biomimetic actin cortices shape cell-sized lipid vesicles*, doi.org/10.1101/2023.01.15.524117, **preprint, in revision** (2026).

Published:

16. M. Muñoz-Basagoiti*, **F. Frey***, B. Meadowcroft*, M. Amaral*, A. Prada* and A. Šarić, *A tutorial for mesoscale computer simulations of lipid membranes: tether pulling, tubulation and fluctuations*, **Soft Matter** 21, 7736-7756 (2025). *Equal contributions.
15. M. Amaral*, **F. Frey***, X. Jiang, B. Baum, A. Šarić, *Balancing stability and flexibility when reshaping archaeal membranes*, **eLife** 14:RP105432 (2025). *Equal contributions.
14. **F. Frey**, U. S. Schwarz, *Coat stiffening can explain invagination of clathrin-coated membranes*, **Phys. Rev. E** 110, 064403 (2024).
13. E. Weiner*, E. Berryman*, **F. Frey***, A. González Solís*, A. Leier, T. Marquez Lago, A. Šarić and M. S. Otegui, *Endosomal Membrane Budding Patterns in Plants*, **Proc. Natl. Acad. Sci. U.S.A.** 121.44: e2409407121 (2024). *Equal contributions.
12. L. Baldauf*, **F. Frey***, M. Arribas Perez, T. Idema, G. H. Koenderink, *Branched actin cortices reconstituted in vesicles sense membrane curvature*, **Biophys. J.** 122.11: 2311-2324 (2023). *Equal contributions.
11. M. Mund, A. Tschanz, Y.-L. Wu, **F. Frey**, J. L. Mehl, M. Kaksonen, O. Avinoam, U. S. Schwarz, and J. Ries, *Clathrin coats partially preassemble and subsequently bend during endocytosis*, **J. Cell Biol.** 222 (3): e202206038 (2023).
10. J. J. de Vries, D. M. Laan, **F. Frey**, G. H. Koenderink, M. P. M. de Maat, *A systematic review and comparison of automated tools for quantification of fibrous networks*, **Acta Biomater.** 157, 263-274 (2022).
9. **F. Frey**, and T. Idema, *Membrane area gain and loss during cytokinesis*, **Phys. Rev. E** 106, 024401 (2022).
8. **F. Frey**, and T. Idema, *More than just a barrier: using physical models to couple membrane shape to cell function*, **Soft Matter**, 17, 3533 – 3549 (2021).
7. **F. Frey**, and U. S. Schwarz, *Competing pathways for the invagination of clathrin-coated membranes*, **Soft Matter** 16, 10723-10733 (2020).
6. **F. Frey**, D. Bucher, K. A. Sochacki, J. W. Taraska, S. Boulant, and U. S. Schwarz, *Eden growth models for flat clathrin lattices with vacancies*, **New J. of Phys.** 22, 073043 (2020).
5. T. Wiegand, M. Fratini, **F. Frey**, K. Yserentant, Y. Liu, E. Weber, K. Galior, J. Ohmes, F. Braun, DP. Herten, S. Boulant, U. S. Schwarz, K. Salaita, E. A. Cavalcanti-Adam, and J. P. Spatz, *Forces during cellular uptake of viruses and nanoparticles at the ventral side*, **Nat. Commun.** 11, 32 (2020).
4. **F. Frey**, F. Ziebert, and U. S. Schwarz, *Dynamics of particle uptake at cell membranes*, **Phys. Rev. E** 100, 052403 (2019).
3. **F. Frey**, F. Ziebert, and U. S. Schwarz, *Stochastic dynamics of nanoparticle and virus uptake*, **Phys. Rev. Lett.** 122, 088102 (2019).
2. D. Bucher*, **F. Frey***, K. A. Sochacki, S. Kummer, JP. Bergeest, W. J. Godinez, HG. Kräusslich, K. Rohr, J. W. Taraska, U. S. Schwarz, and S. Boulant, *Clathrin-adaptor ratio and membrane tension regulate the flat-to-curved transition of the clathrin coat during endocytosis*, **Nat. Commun.** 9, 1109 (2018). *Equal contributions.
1. P. Kumberger, **F. Frey**, U. S. Schwarz, and F. Graw, *Multiscale modeling of virus replication and spread*, **FEBS Lett.** 590, 1972-1986 (2016).