

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

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

Education

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

Fellowships and awards

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| 2022 | <u>Independent NOMIS fellowship</u> (fully funded independent 3-year Postdoc position, worth 242.000€) |
| 2022 | <u>IST-BRIDGE fellowship</u> (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 (<u>declined</u>) |
| 2021 | <u>Kavli Synergy Grant</u> (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 | <u>Full 3-year PhD fellowship</u> 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

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| 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

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| 2025, summer | <u>Lecture substitution</u> (two lectures) at IST Austria in Soft Matter Physics (PhD course) for Prof. Andela 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</u> at TU Delft (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</u> at Heidelberg University (Dennis Wörthmüller, <i>Computer simulations of SAS-6 self-assembly in two dimensions</i>) |
| 2016-2018 | <u>Co-supervision of three Bachelor theses</u> at Heidelberg University (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

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| 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. Mavrakis, 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).