

Curriculum Vitae

Dr. Stefan A. Karpitschka

Research Group Leader (Soft Matter Physics)

Max Planck Institute for Dynamics and Self-Organization
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Research Interests

- Living matter — cell to culture level — active matter, self-organization, emergence
- Soft matter — chemistry to mechanics — elasto-capillarity, shape memory, rheology & singularities
- Fluid physics — micro to macro scale — complex fluids, phase separation, wetting & lubrication

Education

- 09/2008 – 12/2012 **Dr. rer. nat., Physics** (summa cum laude)
Max Planck Institute of Colloids and Interfaces, Potsdam, Germany
Advisors: Prof. Helmuth Möhwald and Dr. Hans Riegler
Thesis: “Dynamics of Liquid Interfaces with Compositional Gradients”
- 10/2002 – 11/2007 **Diploma, Physics** (with distinction)
University of Bayreuth, Germany
Advisors: Prof. J. U. Küppers and Prof. S. Wehner
Thesis: “Reaction Hysteresis of the CO Oxidation Reaction on Pd(111) Surfaces”

Research

- since 05/2017 Research Group Leader
Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany
- 03/2016 – 12/2016 Postdoctoral Researcher
Stanford University, California, United States of America
Advisor: Prof. Manu Prakash
- 01/2014 – 02/2016 Postdoctoral Researcher
University of Twente, Enschede, The Netherlands
Advisors: Prof. Jacco H. Snoeijer and Prof. Detlef Lohse
- 01/2013 – 11/2013 Postdoctoral Researcher
Max Planck Institute of Colloids and Interfaces, Potsdam, Germany
Advisors: Prof. Helmuth Möhwald and Dr. Hans Riegler
- 11/2007 – 03/2008 Research Assistant
University of Bayreuth, Germany
Advisors: Prof. J. U. Küppers and Prof. S. Wehner

Professional Experience

- since 2005 **Self employed** software development & technical consulting
Real time imaging solutions, science & database tools
- 01/2003 – 10/2007 **Development of measurement software**
Chair of Experimental Physics III, University of Bayreuth

Honors & Funding

- **Editors' Suggestion** in *Phys. Rev. Lett.* for "Pinning-Induced Folding-Unfolding Asymmetry in Adhesive Creases" (2021)
- **DFG grant** "Dynamics of Liquid-Liquid-Elastic Three-Phase Contact Lines" in priority program SPP 2171 "Dynamic Wetting of Flexible, Adaptive and Switchable Surfaces" (2019 – 2022)
- **Cover & Featured Article** "Printing wet-on-wet: attraction and repulsion of drops on a viscous film" in *Applied Physics Letters* (2018)
- **Invited publication** "The Value of a Fading Tracer" in the series "Focus on Fluids" by the *Journal of Fluid Mechanics* (2018)
- **Research group** "Interfaces of Complex Fluids" funded by the Max Planck - University of Twente Center for Complex Fluid Dynamics (since 2017)
- **Isaac Newton Institute**, Cambridge, UK (2013): Invited participant at the program "Mathematical Modeling and Analysis of Complex Fluids and Active Media in Evolving Domains"
- **LAM Research AG**, Austria (2012,2013): Industry funded project "Marangoni Drying"
- **Invited publication** with H.R. Brand (2010), special issue of *Physica D* in honor of S.C. Müller

Publications

Key publication metrics:

- Published articles: 35
- Current preprints / under review: 3
- Publications in leading journals (Thomson Reuters):
 - 1 in *Phys. Rev. X* (Impact Factor: 12.58; Rank: 5/85 - Physics, Multidisciplinary)
 - 1 in *Nature Communications* (Impact factor: 12.12; Rank: 6/71 - Multidisciplinary Sciences)
 - 2 in *Proc. Natl. Acad. Sci. USA* (Impact factor: 9.41; Rank: 8/71 - Multidisciplinary Sciences)
 - 6 in *Phys Rev. Lett.* (Impact factor: 8.39; Rank: 6/85 - Physics, Multidisciplinary)
- Total citations: 951 (Google Scholar)
- H-index: 17 (Google scholar)

Peer-reviewed journal publications:

- [35] **Pinning-Induced Folding-Unfolding Asymmetry in Adhesive Creases**
M.A.J. van Limbeek, M.H. Essink, A. Pandey, J.H. Snoeijer, and S. Karpitschka
Phys. Rev. Lett., accepted (2021)
- [34] **Nanoscale Interactions of Colloidal Particles can Suppress Millimetre Drop Splashing**
M.-J. Thoraval, J. Schubert, S. Karpitschka, M. Chanana, F. Boyer, E. Sandoval-Naval, J.F. Dijkman, J.H. Snoeijer, and D. Lohse
Soft Matter, 17, 5116–5121 (2021) DOI: 10.1039/dosm01367f
- [33] **Wetting of Two-Component Drops: Marangoni Contraction Versus Autophobicity**
M.A. Hack, W. Kwieciński, O. Ramírez-Soto, T. Segers, S. Karpitschka, E.S. Kooij, and J.H. Snoeijer
Langmuir, 37, 3605–3611 (2021) DOI: 10.1021/acs.langmuir.0c03571
- [32] **Regimes of Soft Lubrication**
M.H. Essink, A. Pandey, S. Karpitschka, C.H. Venner, and J.H. Snoeijer
J. Fluid Mech., 915, A49 (2021) DOI: 10.1017/jfm.2021.96
- [31] **Singular Nature of the Elastocapillary Ridge**
A. Pandey, B. Andreotti, S. Karpitschka, G.J. van Zwieten, E.H. van Brummelen, and J.H. Snoeijer
Phys. Rev. X, 10, 031067 (2020) DOI: 10.1103/physrevx.10.031067
- [30] **Living System Adapts Harmonics of Peristaltic Wave for Cost-Efficient Optimization of Pumping Performance**
F.K. Bäuerle, S. Karpitschka, and K. Alim
Phys. Rev. Lett., 124, 098102 (2020) DOI: 10.1103/physrevlett.124.098102
- [29] **Spreading on Viscoelastic Solids: Are Contact Angles Selected by Neumann's Law?**
M. van Gorcum, S. Karpitschka, B. Andreotti, and J.H. Snoeijer
Soft Matter, 16, 1306–1322 (2020) DOI: 10.1039/c9sm01453e

- [28] **Dynamic Force Measurements on Swimming Chlamydomonas Cells Using Micropipette Force Sensors**
T.J. Bøddeker, **S. Karpitschka**, C.T. Kreis, Q. Magdelaine, and O. Bäümchen
J. Royal Soc. Interf., 17, 20190580 (2020) DOI: 10.1098/rsif.2019.0580
- [27] **Solutal Marangoni Flow as the Cause of Ring Stains from Drying Salty Colloidal Drops**
A. Marin, **S. Karpitschka**, D. Noguera-Marín, M.A. Cabrerizo-Vílchez, M. Rossi, C.J. Kähler, and M.A. Rodríguez Valverde
Phys. Rev. Fluids, 4, 041601(R) (2019) DOI: 10.1103/PhysRevFluids.4.041601
- [26] **Peeling an Elastic Film from a Soft Viscoelastic Adhesive: Experiments and Scaling Laws**
H. Perrin, A. Eddi, **S. Karpitschka**, J.H. Snoeijer, and B. Andreotti
Soft Matter, 15, 770 – 778 (2019) DOI: 10.1039/c8sm01946k
- [25] **Dynamic Solid Surface Tension Causes Droplet Pinning and Depinning**
M. van Gorcum, B. Andreotti, J.H. Snoeijer, and **S. Karpitschka**
Phys. Rev. Lett., 121, 208003 (2018) DOI: 10.1103/PhysRevLett.121.208003
- [24] **Printing Wet-on-Wet: Attraction and Repulsion of Drops on a Viscous Film**
M.A. Hack, M. Costalonga, T. Segers, **S. Karpitschka**, H. Wijshoff, and J.H. Snoeijer
Appl. Phys. Lett., 113, 183701 (2018) DOI: 10.1063/1.5048681
- [23] **The Value of a Fading Tracer**
S. Karpitschka
J. Fluid Mech., 856, 1 – 4 (2018) DOI: 10.1017/jfm.2018.673
- [22] **Delayed Coalescence of Surfactant Containing Sessile Droplets**
M.A. Bruning, M. Costalonga, **S. Karpitschka**, and J.H. Snoeijer
Phys. Rev. Fluids, 3, 073605 (2018) DOI: 10.1103/PhysRevFluids.3.073605
- [21] **Soft Wetting: Models Based on Energy Dissipation or on Force Balance are Equivalent**
S. Karpitschka, S. Das, M. van Gorcum, H. Perrin, B. Andreotti, and J.H. Snoeijer
Proc. Natl. Acad. Sci. USA, 115, E7233 (2018) DOI: 10.1073/pnas.1808870115
- [20] **Cusp-Shaped Elastic Creases and Furrows**
S. Karpitschka, J. Eggers, A. Pandey, and J.H. Snoeijer
Phys. Rev. Lett., 119, 198001 (2017) DOI: 10.1103/PhysRevLett.119.198001
- [19] **Dynamical Theory of the Inverted Cheerios Effect**
A. Pandey, **S. Karpitschka**, L.A. Lubbers, J.H. Weijs, L. Botto, S. Das, B. Andreotti, and J.H. Snoeijer
Soft Matter, 13, 6000 (2017) DOI: 10.1039/C7SM00690J
- [18] **Marangoni Contraction of Evaporating Sessile Droplets of Binary Mixtures**
S. Karpitschka, F. Liebig, and H. Riegler
Langmuir, 33, 4682 – 4687 (2017) DOI: 10.1021/acs.langmuir.7b00740
- [17] **Shape of a Sessile Drop on a Flat Surface Covered with a Liquid Film**
M. Tress, **S. Karpitschka**, P. Papadopoulos, J.H. Snoeijer, D. Vollmer, and H.-J. Butt
Soft Matter, 13, 3760 – 3767 (2017) DOI: 10.1039/c7sm00437k
- [16] **Lubrication of Soft Viscoelastic Solids**
A. Pandey, **S. Karpitschka**, C. Venner, and J.H. Snoeijer
J. Fluid Mech., 799, 433 – 447 (2016) DOI: 10.1017/jfm.2016.375
- [15] **Liquid Drops Attract or Repel by the Inverted Cheerios Effect**
S. Karpitschka, A. Pandey, L.A. Lubbers, J.H. Weijs, L. Botto, S. Das, B. Andreotti, and J.H. Snoeijer
Proc. Natl. Acad. Sci. USA, 113, 7403 – 7407 (2016) DOI: 10.1073/pnas.1601411113
- [14] **Surface Tension Regularizes the Crack Singularity of Adhesion**
S. Karpitschka, L. van Wijngaarden, and J.H. Snoeijer
Soft Matter, 12, 4463 – 4471 (2016) DOI: 10.1039/C5SM03079J
- [13] **Droplets Move over Viscoelastic Substrates by Surfing a Ridge**
S. Karpitschka, S. Das, M. van Gorcum, H. Perrin, B. Andreotti, and J.H. Snoeijer
Nature Commun., 6, 7891 (2015) DOI: 10.1038/ncomms8891
- [12] **The Evaporation Behavior of Sessile Droplets from Aqueous Saline Solutions**
V. Soulié, **S. Karpitschka**, F. Lequien, P. Prené, T. Zemb, H. Möhwald, and H. Riegler
Phys. Chem. Chem. Phys., 17, 22296 – 22303 (2015) DOI: 10.1039/C5CP02444G
- [11] **Periodic Precipitation Patterns during Coalescence of Reacting Sessile Droplets**
M. Jehannin, S. Charton, **S. Karpitschka**, T. Zemb, H. Möhwald, and H. Riegler
Langmuir, 31, 11484 – 11490 (2015) DOI: 10.1021/acs.langmuir.5b02482

- [10] **Spin Casting of Dilute Solutions: Vertical Composition Profile During Hydrodynamic-Evaporative Film Thinning**
S. Karpitschka, C. Weber, and H. Riegler
Chem. Eng. Sci., 129, 243 – 248 (2015) DOI: 10.1016/j.ces.2015.01.028
- [9] **Travelling Fronts of the CO Oxidation on Pd(111) with Coverage-Dependent Diffusion**
J. Cisternas, S. Karpitschka, and S. Wehner
J. Chem. Phys., 141, 164106 (2014) DOI: 10.1063/1.4898705
- [8] **Coalescence and Noncoalescence of Sessile Drops: Impact of Surface Forces**
S. Karpitschka, C. Hanske, A. Fery, and H. Riegler
Langmuir, 30, 6826 – 6830 (2014) DOI: 10.1021/la500459v
- [7] **Sharp Transition between Coalescence and Non-Coalescence of Sessile Drops**
S. Karpitschka and H. Riegler
J. Fluid Mech. Rapids, 743, R1 (2014) DOI: 10.1017/jfm.2014.73
- [6] **Noncoalescence of Sessile Drops from Different but Miscible Liquids: Hydrodynamic Analysis of the Twin Drop Contour as a Self-Stabilizing Traveling Wave**
S. Karpitschka and H. Riegler
Phys. Rev. Lett., 109, 066103 (2012) DOI: 10.1103/PhysRevLett.109.066103
- [5] **Nonintrusive Optical Visualization of Surface Nanobubbles**
S. Karpitschka, E. Dietrich, J.R.T. Seddon, H.J.W. Zandvliet, D. Lohse, and H. Riegler
Phys. Rev. Lett., 109, 066102 (2012) DOI: 10.1103/PhysRevLett.109.066102
- [4] **Delayed Coalescence of Droplets with Miscible Liquids: Lubrication and Phase Field Theories**
R. Borica, S. Menzel, M. Bestehorn, S. Karpitschka, and H. Riegler
Euro. Phys. J. E, 34, 24 (2011) DOI: 10.1140/epje/i2011-11024-9
- [3] **Quantitative Experimental Study on the Transition between Fast and Delayed Coalescence of Sessile Droplets with Different but Completely Miscible Liquids**
S. Karpitschka and H. Riegler
Langmuir, 26, 11823 – 11829 (2010) DOI: 10.1021/la1007457
- [2] **Stochastic Aspects of Pattern Formation during the Catalytic Oxidation of CO on Pd(111) Surfaces**
S. Wehner, S. Karpitschka, Y. Burkov, D. Schmeisser, J. Küppers, and H.R. Brand
Physica D, 239, 746 – 751 (2010) DOI: 10.1016/j.physd.2009.06.010
- [1] **Reaction Hysteresis of the CO + O → CO₂ Reaction on Palladium(111)**
S. Karpitschka, S. Wehner, and J. Küppers
J. Chem. Phys., 130, 054706 (2009) DOI: 10.1063/1.3072712

Talks & Seminars

Invited seminars & talks:

- 2021 — *Fluids & Materials Seminar*, University of Bristol, UK
- 2021 — *Nanoeminar*, University of Utrecht, The Netherlands
- 2021 — *LOMA Seminar*, University of Bordeaux, France
- 2020 — *SPP2171 Winter School "Introduction to Wetting Dynamics"*, Münster, Germany
- 2019 — *WE-Heraeus Seminar "Wetting on Soft or Microstructured Surfaces"*, Bad Honnef, Germany
- 2019 — *DPG Spring Meeting*, Regensburg, Germany
- 2019 — Manchester University, Manchester, UK
- 2018 — *POF20 Conference*, Universiteit Twente, Enschede, The Netherlands
- 2017 — Industry club workshop on droplet coalescence, Durham University, UK
- 2017 — MPI-DS Advances Seminar, Göttingen, Germany
- 2017 — IUSTI, Université Aix-Marseille, Marseille, France
- 2017 — Max Planck - University of Twente Center Kickoff Meeting, Göttingen, Germany
- 2016 — SFB1194 Kickoff Meeting, Darmstadt, Germany
- 2015 — *Lorentz Center Workshop "Capillarity of Soft Interfaces"*, Leiden, The Netherlands
- 2015 — University of Münster (AG Prof. U. Thiele), Zaferna Workshop
- 2015 — Bioengineering Department, Stanford University, USA
- 2015 — Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany
- 2014 — University of Münster (AG Prof. U. Thiele), Zaferna Workshop

- 2013 — Isaac Newton Institute Workshop, “Complex Fluids in Evolving Domains”, Leeds, UK
- 2013 — Universität der Bundeswehr, Munich, Germany
- 2012 — *Nanobubbles and Micropancakes*, l'École de Physique des Houches, Les Houches, France
- 2011 — Chemical Engineering Department, Technion, Haifa, Israel

Selected conference contributions:

- 2021 — *DPG Spring Meeting BPCPPDYSOE*, online
- 2019 — *APS DFD Meeting*, Seattle, USA
- 2018 — *DPG Spring Meeting*, Berlin, Germany
- 2016 — *APS March Meeting*, Baltimore, USA
- 2015 — *Fluid & Elasticity*, Biarritz, France
- 2014 — *APS DFD Meeting*, San Francisco, USA
- 2014 — *Flow14*, Enschede, The Netherlands
- 2013 — *Droplets 2013*, Marseille, France
- 2012 — *6th Conference of the International Marangoni Association*, Haifa, Israel
- 2011 — *FluidDTU Summerschool*, Krogerup, Denmark
- 2010 — *Lorentz Center Workshop “Capillary Shaping of Solutes”*, Leiden, The Netherlands
- 2010 — *5th Conference of the International Marangoni Association*, Florence, Italy
- 2010 — *24th Conference of the European Colloid and Interface Society*, Prag, Czech Republic
- 2008 — *DPG Spring Meeting*, Berlin, Germany

Teaching

- **Rheology of Viscoelastic Liquids and Solids** graduate lab course (summer term 2021)
- **Peristalsis** guest lecture, Biofluidmechanics master course, University of Göttingen (winter term 2020/21)
- **Physics of Sports** seminar, University of Göttingen, master course (open to interested bachelor students, winter term 2020/21 (online), 2018/19)
- **Physics for Students of Human and Dental Medicine** lecture, University of Göttingen, (winter term 2019/20)
- **Climate Physics** lecture, University of Göttingen, master course (open to PhD- & interested bachelor students, summer term 2019)
- **Current Topics in Dynamics of Complex Fluids** seminar, University of Göttingen & MPI-DS, master course (since 2017, biannually)
- **Fluid & Elasticity** lecture, University of Twente, master course (tutorial organization & step-in lectures, with Prof. Jacco Snoeijer, 2015)
- **Experimental Techniques in Physics of Fluids** lab class, University of Twente, bachelor course (teaching assistant, with Prof. Michel Versluis, 2014)
- **Physical Chemistry III (Spectroscopy & Crystallography)** lecture, University of Potsdam, bachelor course (tutorial organization, with Prof. Helmuth Möhwald, winter terms 2008/09 & 2009/10)

Mentoring & Supervision

- **Main advisor** for 2 bachelor thesis projects, 4 PhD students & 3 post-docs (since 2017)
- **Internship host**, “Ludwig Prantl Internships” (8-12 weeks), 3 internships since 2018
- **Mentoring & co-advising** of ~10 PhD, master- & bachelor students (2011-2016)

Service

- **Symposium organizer** DPG virtual spring meeting BP-CPP-DY-SOE 2021, *Wetting*
- **Symposium organizer** DPG spring meeting 2020, *Dynamical wetting of flexible, adaptive and switchable surfaces (SYDW)*

- **Theme organizer** for *Coalescence & Breakup*, “Droplets 2019” conference, Durham, UK
- **Campus Seminar** organization team, interdisciplinary graduate student seminar (Biology, Physics, Chemistry), MPI-DS and MPI-BPC (since 2019)
- Hosted two **high-school internships** “Levitating microdrops over the surface of hot water” (2019)
- Member of the **coordination board**, DFG Priority Program 2171, “Dynamic Wetting of Flexible, Adaptive and Switchable Surfaces” (since 2018)
- Co-authored the **initiative proposal** for a DFG Priority Program “Dynamic Wetting of Flexible, Adaptive and Switchable Surfaces” (with H.-J. Butt, D. Vollmer, R. Seemann & U. Thiele, 2017)
- **Girls & Boys Day** 2018: “Dancing Droplets”, Experiments with High School Students
- **Popular science talk** with live demonstration experiments “Dancing Droplets”, Science Summer Festival, Faßberg Campus Göttingen (2017)
- Member of the **organizing committee**, “Droplets 2015” conference, Enschede, The Netherlands
- Contributions to proof-reading **Intermolecular and Surface Forces** by J.N. Israelachvili, 3rd edition, 2011, Academic Press
- Organization of the **Summerschool** of the Interfaces Department, Max Planck Institute of Colloids and Interfaces, Albufeira, Portugal (2009)
- **Experiments for Children**, “Paper boats with Marangoni motor”, Max Planck Institute of Colloids and Interfaces, open day 2009
- Numerous **lab demonstrations** for a wide variety of audiences
- **Peer-reviewing** for *Physical Review X*, *Physical Review Letters*, *Physical Review E*, *ACS Nano*, *Science Advances*, *Proceedings of the Royal Society A*, *Journal of Fluid Mechanics*, *Physics of Fluids*, *Langmuir*, *Soft Matter*, *Journal of Physical Chemistry*, *Journal of Polymer Science B*, *Chemical Engineering Science*, *European Journal of Mechanics B*

Media coverage

- **Sep 2016** — Physics World, *Physics at the breakfast table*, Karpitschka et al., *Proc. Natl. Acad. Sci. USA* 113, 7403 (2016)
- **Jul 2016** — New York Times, *‘Inverted Cheerios Effect’ Returns Physics to the Breakfast Table*, Karpitschka et al., *Proc. Natl. Acad. Sci. USA* 113, 7403 (2016)
- **Jun 2016** — The Australian, Karpitschka et al., *Proc. Natl. Acad. Sci. USA* 113, 7403 (2016)
- **Jun 2016** — Phys.org and about 30 other news outlets, *How scientists inverted the cheerios effect*, Karpitschka et al., *Proc. Natl. Acad. Sci. USA* 113, 7403 (2016)
- **Aug 2015** — Science Daily and several other news outlets, *Surfing droplets: Movement of droplets on soft surfaces*, Karpitschka et al., *Nature Commun.* 6, 7891 (2015)
- **Aug 2015** — Independence News, *Surfing droplets in Nature Communications*, Karpitschka et al., *Nature Commun.* 6, 7891 (2015)
- **Sep 2012** — Nature Nanotechnology, News & Views, *Nanobubbles: Imaged with a light touch*, Karpitschka et al., *Phys. Rev. Lett.* 109, 066102 (2012)