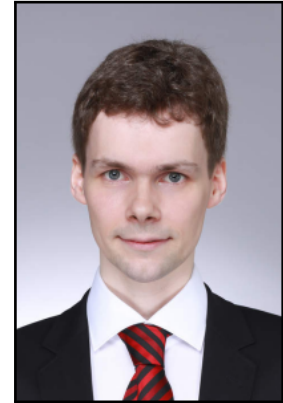


Curriculum vitae

See <https://www.uni-muenster.de/Physik.TP/~wittkowski/cv.pdf> for an update.



Personal data

Prof. Dr. Raphael Wittkowski
born in May 1988 in Düsseldorf, Germany

Contact information

Institut für Theoretische Physik
Center for Soft Nanoscience
Westfälische Wilhelms-Universität Münster
✉ Busso-Peus-Straße 10, 48149 Münster
☎ +49 (0)251 83 34529
✉ raphael.wittkowski@uni-muenster.de
🌐 <https://www.uni-muenster.de/Physik.TP/~wittkowski/>

School and academic education

- 27/03/2012 *Doctor rerum naturalium* in physics (“summa cum laude”)
10/2010-03/2012 Doctoral studies with Prof. Dr. Hartmut Löwen at the Institute for Theoretical Physics II of the Heinrich-Heine-Universität in Düsseldorf, Germany
- 29/09/2010 *Master of Science* in physics (“with honors”)
10/2009-09/2010 Master degree course in physics at the Heinrich-Heine-Universität in Düsseldorf, Germany
Master thesis with Prof. Dr. Hartmut Löwen at the Institute for Theoretical Physics II (soft matter physics)
- 25/09/2009 *Bachelor of Science* in physics (“with honors”)
10/2006-09/2009 Bachelor degree course in physics at the Heinrich-Heine-Universität in Düsseldorf, Germany
Bachelor thesis with Prof. Dr. Karl-Heinz Spatschek at the Institute for Theoretical Physics I (plasma physics)
- 29/07/2009 *Bachelor of Science* in mathematics (“with honors”)
10/2006-07/2009 Bachelor degree course in mathematics at the Heinrich-Heine-Universität in Düsseldorf, Germany
Bachelor thesis with Prof. Dr. Marlis Hochbruck at the Institute for Applied Mathematics

17/06/2006 *Abitur* (grade 1.1, “very good”)
 08/1998-06/2006 Heinrich-Heine-Gymnasium in Mettmann, Germany
 08/1994-08/1998 Christian-Morgenstern-Grundschule in Ratingen, Germany

Professional career

04/2017-today Assistant Professor (W1) at the Institute of Theoretical Physics of the Westfälische Wilhelms-Universität in Münster, Germany
 10/2016-today Emmy Noether research group leader at the Institute of Theoretical Physics of the Westfälische Wilhelms-Universität in Münster, Germany
 01/2015-09/2016 Postdoctoral research fellow with Prof. Dr. Hartmut Löwen at the Institute for Theoretical Physics II of the Heinrich-Heine-Universität in Düsseldorf, Germany
 01/2013-12/2014 Postdoctoral research fellow with Prof. Dr. Michael E. Cates at the School of Physics and Astronomy of the University of Edinburgh in Edinburgh, United Kingdom
 04/2012-12/2012 Postdoctoral research associate with Prof. Dr. Hartmut Löwen at the Institute for Theoretical Physics II of the Heinrich-Heine-Universität in Düsseldorf, Germany
 10/2010-03/2012 Research associate with Prof. Dr. Hartmut Löwen at the Institute for Theoretical Physics II of the Heinrich-Heine-Universität in Düsseldorf, Germany

Awards, fellowships, and grants

Third-party funds raised from the Deutsche Forschungsgemeinschaft: ≈ 1660 k€
Additional third-party funds raised: ≈ 40 k€

01/2021-12/2024 Research Grant of the “Deutsche Forschungsgemeinschaft” (German Research Foundation), Collaborative Research Center 1459 “Intelligent matter: From responsive to adaptive nanosystems”, subproject “Towards intelligent light-propelled nano- and microsystems” (amount: ≈ 256 k€)
 01/05/2019 Honored as “Emerging Leader” (identified as one of “the best early-career researchers from all areas of condensed matter physics [...] with the potential to revolutionise their fields”) by the editorial board of the Journal of Physics: Condensed Matter
 01/2019-12/2023 Membership in the “Junges Kolleg” (Young Academy) of the North Rhine-Westphalian Academy of Sciences, Humanities and the Arts and accompanying research fellowship (amount: 40 k€)

- 10/2016-12/2022 Emmy Noether Research Grant of the “Deutsche Forschungsgemeinschaft” (German Research Foundation), project “Controlling the dynamics of active colloidal liquid crystals by external fields” (amount: ≈ 1347 k€)
- 07/2015-09/2016 Postdoctoral research fellowship of the Heinrich-Heine-Universität in Düsseldorf
- 01/2015-06/2015 Return fellowship of the “Deutsche Forschungsgemeinschaft” (German Research Foundation) (amount: ≈ 9 k€)
- 01/2013-12/2014 Postdoctoral research fellowship of the “Deutsche Forschungsgemeinschaft” (German Research Foundation), project “Theory of the collective nonequilibrium dynamics of active colloidal particles” (amount: ≈ 49 k€)
- 30/01/2013 Dissertation award “Beste Dissertation in der Mathematisch-Naturwissenschaftlichen Fakultät 2012” (Best dissertation in the Faculty of Mathematics and Natural Sciences of the year 2012) of the Heinrich-Heine-Universität in Düsseldorf
- 05/2012-12/2012 Postdoctoral research fellowship of the Heinrich-Heine-Universität in Düsseldorf
- 06/2008-07/2008 Travel grant from the “Wilhelm und Else Heraeus-Stiftung” (Wilhelm and Else Heraeus Foundation) for the 58th Lindau Nobel Laureate Meeting (Physics) from June 29 to July 4, 2008, in Lindau, Germany
- 10/2006-09/2011 Study scholarship of the “Studienstiftung des deutschen Volkes” (German Academic Scholarship Foundation)
- 17/06/2006 Book award of the “Deutsche Physikalische Gesellschaft” (German Physical Society)

Supervision

Currently supervised persons:

14 *persons in total* (8 *undergraduate students*, 6 *doctoral candidates*)

Jens Bickmann, M.Sc.
 Stephan Bröker, M.Sc.
 Julian Jeggle, M.Sc.
 Tobias Nitschke, M.Sc.
 Johannes Voß, M.Sc.
 Michael te Vrugt, M.Sc.

Lea Krüger, B.Sc.
 Lennart Küpers, B.Sc.
 Jonas Mayer Martins, B.Sc.
 Adrian Paskert, B.Sc.

Tillmann Beisenkötter
Christoph Hemming
Lisa Michelmann
Alexander Tiekötter

Formerly supervised theses:

26 theses since 2017 in total (12 Bachelor's theses, 10 Master's theses, 4 doctoral theses)

- XX/0X/2022 Jens Bickmann, doctoral thesis, "*Collective dynamics of active Brownian particle systems*" (thesis submitted)
- XX/0X/2022 Johannes Voß, doctoral thesis, "*Acoustic propulsion of colloidal particles*" (thesis submitted)
- XX/0X/2022 Tobias Nitschke, doctoral thesis, "*Kollektive Steuerung akustisch angetriebener Nano- und Mikropartikel für medizinische Anwendungen*" (thesis submitted)
- 22/02/2022 Anthony Pietz, Master's thesis, "*Acoustic propulsion of asymmetric colloidal molecules: an analytical approach*"
- 28/01/2022 Jonas Hallekamp, Master's thesis, "*Photonic propulsion of gradient-index microspheres: simulation results and analytic representation*"
- 23/12/2021 Hauke Hawighorst, Bachelor's thesis, "*Kollektive Dynamik lichtangetriebener, brownischer Teilchen mit orientierungsabhängigem Antrieb in zwei Dimensionen*"
- 05/11/2021 Julian Jeggle, Master's thesis, "*Numerical simulations of soft matter systems using modern compiler techniques*"
- 04/10/2021 Lea Krüger, Bachelor's thesis, "*Reconstruction of the stress exerted on a radially deformed spherical particle from the deformation of its surface: an analytical approach*"
- 29/09/2021 Jonas Mayer Martins, Bachelor's thesis, "*Inertial dynamics of self-propelled asymmetric particles*"
- 15/10/2020 Jonas Krüger, Bachelor's thesis, "*Machine-learning-based guiding of active colloidal particles*"
- 05/10/2020 Adrian Paskert, Bachelor's thesis, "*Strukturabhängige Eigenschaften lichtangetriebener refraktiver Mikroteilchen*"
- 29/09/2020 Lennart Küpers, Bachelor's thesis, "*Akustischer Antrieb kolloidaler Moleküle in einer stehenden Ultraschallwelle*"
- 28/09/2020 Elias Koch, Bachelor's thesis, "*Field-theoretical investigation of a two-dimensional crystal of spherical active colloidal particles*"
- 30/09/2019 Jonas Hallekamp, Bachelor's thesis, "*Thermophorese in verdünnten Suspensionen aktiver brownischer Teilchen*"
- 19/09/2019 Jan Nellesen, Bachelor's thesis, "*Symmetriebasierte Herleitung lokaler Feldtheorien*"

17/09/2019	Michael te Vrugt, Master's thesis, " <i>Mori-Zwanzig projection operator formalism for systems with time-dependent Hamiltonians: derivation and applications</i> "
05/07/2019	Daniel Lahrmann*, Master's thesis, " <i>Phase-field-crystal models for colloidal liquid crystals</i> "
13/06/2019	Marina Evers, Master's thesis, " <i>Dynamics of active colloidal crystals</i> "
30/04/2019	Jens Bickmann, Master's thesis, " <i>Field theories for spherical active Brownian particles</i> "
18/12/2018	Alejandro Jurado*, Master's thesis, " <i>Photonic propulsion of refractive microparticles</i> "
14/09/2018	Stephan Bröker, Master's thesis, " <i>Kollektive Dynamik und Paarverteilungsfunktion aktiver brownischer Teilchen im dreidimensionalen Raum</i> "
14/09/2018	Johannes Voß, Master's thesis, " <i>Fortbewegung selbstkustophoretischer kolloidaler Teilchen</i> "
27/11/2017	Christoph Sitta*, doctoral thesis, " <i>Struktur und Dynamik weicher Materie: Von zweidimensionalen Flüssigkristallen zu makromolekularer Diffusion durch Gele</i> "
29/09/2017	Alexander Sprenger*, Bachelor's thesis, " <i>Brownian motion of orientation-dependent activity</i> "
18/09/2017	Thilo Hahn*, Bachelor's thesis, " <i>Herleitung und Vergleich von Phasenfeldkristallmodellen unterschiedlicher Ordnung</i> "
27/07/2017	Julian Jeggle, Bachelor's thesis, " <i>Paarkorrelationsfunktion und kollektives Verhalten einer zweidimensionalen Suspension aktiver kolloidaler Teilchen</i> "
2010-2016	Several persons co-supervised as doctoral candidate and postdoctoral researcher

*Member of two research groups, joint supervision

Teaching

Up to now 11 lecture courses (6x Bachelor, 5x Master; incl. 2x Teacher Education), 29 seminars (5x Bachelor, 12x Master, 12x general), some substitute lectures and some exercise groups. In addition, there are some invited lectures (see "*List of talks and poster presentations*", current version at https://www.uni-muenster.de/Physik.TP/wittkowski/talks_rw.pdf).

SS 2022	Master seminar "Theory of complex systems" ^{LT} Research seminar "Self-organization and complexity" ^{GT}
WS 2021/2022	Master lecture course "Introduction to the theory of phase transitions" ^{UT}

	Bachelor lecture course “Numerische Lösung physikalischer Probleme”
	Bachelor lecture course “Mathematik für das Lehramt Physik an Haupt-, Real- und Gesamtschulen”
	Master seminar “Theory of complex systems” ^{LT}
	Bachelor seminar “Theorie der Atome, Kerne und kondensierten Materie” ^{TP}
	Research seminar “Self-organization and complexity” ^{GT}
SS 2021	Bachelor lecture course “Einführung in das wissenschaftliche Programmieren”
	Master seminar “Theory of complex systems” ^{LT}
	Research seminar “Self-organization and complexity” ^{GT}
WS 2020/2021	Master lecture course “Introduction to the theory of phase transitions” ^{UT}
	Bachelor lecture course “Mathematik für das Lehramt Physik an Haupt-, Real- und Gesamtschulen”
	Master seminar “Theory of complex systems” ^{LT}
	Bachelor seminar “Theorie der Atome, Kerne und kondensierten Materie” ^{TP}
	Research seminar “Self-organization and complexity” ^{GT}
SS 2020	Master seminar “Theory of complex systems” ^{LT}
	Research seminar “Self-organization and complexity” ^{GT}
WS 2019/2020	Master lecture course “Introduction to the theory of phase transitions” ^{UT}
	Bachelor lecture course “Numerische Lösung physikalischer Probleme”
	Master seminar “Theory of complex systems” ^{LT}
	Bachelor seminar “Theorie der Atome, Kerne und kondensierten Materie” ^{TP}
	Research seminar “Self-organization and complexity” ^{GT}
SS 2019	Bachelor lecture course “Einführung in das wissenschaftliche Programmieren”
	Master seminar “Theory of complex systems” ^{LT}
	Research seminar “Self-organization and complexity” ^{GT}
WS 2018/2019	Master lecture course “Theory of phase transitions” ^{UT}
	Master seminar “Theory of complex systems” ^{LT}
	Bachelor seminar “Theorie der Atome, Kerne und kondensierten Materie” ^{TP}
	Research seminar “Self-organization and complexity” ^{GT}

SS 2018	Master seminar “Theory of complex systems” ^{LT} Research seminar “Self-organization and complexity” ^{GT}
WS 2017/2018	Master lecture course “Dynamics of phase transitions” ^{UT} Master seminar “Theory of complex systems” ^{LT} Bachelor seminar “Theorie der Atome, Kerne und kondensierten Materie” ^{TP} Research seminar “Self-organization and complexity” ^{GT}
SS 2017	Master seminar “Theory of complex systems” ^{LT} Research seminar “Self-organization and complexity” ^{GT}
WS 2016/2017	Master seminar “Theory of complex systems” ^{LT} Research seminar “Self-organization and complexity” ^{GT}
SS 2015-SS 2016, WS 2012/2013, WS 2011/2012, SS 2011, WS 2010/2011	Involvement in the teaching of the Institute for Theoretical Physics II of the Heinrich-Heine-Universität in Düsseldorf within the Bachelor’s and Master’s degree programmes in physics, including leading of exercise groups and giving lectures as a substitute

^{UT}Together with Prof. Dr. Uwe Thiele

^{LT}Together with Prof. Dr. Stefan Linz and Prof. Dr. Uwe Thiele

^{GT}Together with members of the research group Thiele

^{TP}Together with other teachers of theoretical physics

Involvement in academic self-administration

12/01/2022	Representative of the Institute of Theoretical Physics in the selection committee for the Infineon Dissertation Award 2021
10/2021-09/2022	Membership in the Quality Improvement Committee
10/2020-09/2022	Membership in the Committee for Research and Young Academics Membership in the Study Advisory Board
16/01/2019	Representative of the Institute of Theoretical Physics in the selection committee for the Infineon Master Award 2019
04/2018-07/2018	Development of a speaker programme for the Institute of Theoretical Physics as a contribution to the programme of the Alumni Day (July 7, 2018) of the Department of Physics
17/01/2018	Representative of the Institute of Theoretical Physics in the selection committee for the Infineon Master Award 2018
14/07/2017	Representative of the Institute of Theoretical Physics in the selection committee for the Infineon Dissertation Award 2017
27/06/2017	Representative of the professors of the Department of Physics in the electoral committee of the university

Active Memberships

2021-today	Wigner Initiative
2019-today	Young Academy of the North Rhine-Westphalian Academy of Sciences, Humanities and the Arts
2006-today	German Physical Society

Research

See https://www.uni-muenster.de/Physik.TP/wittkowski/research_rw.pdf for details.

The research of R.W. is **interdisciplinary** and **broad**. It focuses on the investigation of **nonlinear systems** (usually **complex systems**) from a wide range of fields. The thematic focus is on **statistical physics** (quantum mechanical [minor], classical [mainly], general relativistic [minor]), **active matter physics**, **soft matter physics**, and **biophysics**. It addresses also emerging new challenges (e.g., the spreading of the coronavirus disease). A central question is how the properties of systems arise from the properties of the underlying constituents.

R.W.'s research involves the application of a variety of **analytical methods** (mainly analytical modeling) and **numerical methods** (mainly computer simulations) of theoretical and computational physics. The methods cover **microscopic, mesoscopic, and macroscopic scales** and include methods that address systems on particular scales as well as **scale-bridging methods** that allow to map smaller onto larger scales. R.W. is also involved in the **(further) development of methods and scientific software**.

Selected publications

See “List of publications” for a complete overview, current version at https://www.uni-muenster.de/Physik.TP/wittkowski/publications_rw.pdf.

a) Ten best peer-reviewed articles

- [1] M. te Vrugt, H. Löwen, and R. Wittkowski,
Classical dynamical density functional theory: from fundamentals to applications,
Advances in Physics **69**, 121–247 (2020). DOI: 10.1080/00018732.2020.1854965.
Press reports: [7thSpace](#), [Bioengineer](#), [Brinkwire](#), [EurekAlert!](#),
[Informationsdienst Wissenschaft](#), [Infosurhoy](#), [Phys.org](#), [Science Bulletin](#),
[ScienceDaily](#), [Sciencesprings](#), [Scienmag](#), [University of Düsseldorf](#), [University of Münster](#).
- [2] M. te Vrugt, J. Bickmann, and R. Wittkowski,
Effects of social distancing and isolation on epidemic spreading modeled via dynamical density functional theory,
Nature Communications **11**, 5576 (2020). DOI: 10.1038/s41467-020-19024-0.

Featured article. Selected as Editors' Highlight for the Focus "Applied physics and mathematics". Selected for a Focus in *Physik Journal* **20**, 6, 18-19 (2021). Press reports: Abitur und Studium, Analytik News, Archytele, Avalanches, Bioengineer, Bion, Bocholter-Borkener Volksblatt, DE24 News, Deutsches Ärzteblatt, Dorstener Zeitung, EurekAlert!, Healthcare Hygiene Magazine, Heilpraxisnet, Informationsdienst Wissenschaft, JuraForum, Laborpraxis, Medical Xpress, Münsterland-Zeitung, myScience, Nachedeu, NewsBeezer, NotiUlti, Osel, Pediatric Radiology, Research in Germany, Ruhr-Nachrichten, ScienceDaily, Scienmag, Stadt4.0, Tekk.tv, TheDietWorld, TodayHeadline, University of Münster, Wemp, Westfälische Nachrichten, wissen|leben, Wissen.Newzs.

- [3] R. Wittkowski, A. Tiribocchi, J. Stenhammar, R. J. Allen, D. Marenduzzo, and M. E. Cates, *Scalar ϕ^4 field theory for active-particle phase separation*, *Nature Communications* **5**, 4351 (2014). DOI: 10.1038/ncomms5351.
- [4] B. ten Hagen, F. Kümmel, R. Wittkowski, D. Takagi, H. Löwen, and C. Bechinger, *Gravitaxis of asymmetric self-propelled colloidal particles*, *Nature Communications* **5**, 4829 (2014). DOI: 10.1038/ncomms5829. Selected for a Focus in *Physik Journal* **13**, 10, 21-23 (2014). Press reports: DRadio Wissen, Innovations-Report, LABO, Max Planck Society, Phys.org, University of Düsseldorf, University of Stuttgart, VBIO.
- [5] J. Stenhammar, R. Wittkowski, D. Marenduzzo, and M. E. Cates, *Light-induced self-assembly of active rectification devices*, *Science Advances* **2**, e1501850 (2016). DOI: 10.1126/sciadv.1501850. Selected as Research Highlight in *Nature Physics* **12**, 376 (2016). Press reports: Big News Network, Business Standard, Dagens Nyheter, Daijiworld, DesignNews, ECN, EurekAlert!, FARS News, Forskning.se, Lund University, Nanotechnology Now, Newkerala, Noodles, Nvs24, ScienceDaily, Space Daily, University of Düsseldorf, Zee News.
- [6] H. Emmerich, H. Löwen, R. Wittkowski, T. Gruhn, G. I. Tóth, G. Tegze, and L. Gránásy, *Phase-field-crystal models for condensed matter dynamics on atomic length and diffusive time scales: an overview*, *Advances in Physics* **61**, 665–743 (2012). DOI: 10.1080/00018732.2012.737555.
- [7] S. Raghuraman, A.-S. Schubert, S. Bröker, A. Jurado, A. Müller, M. Brandt, B. E. Vos, A. D. Hofemeier, F. Abbasi, M. Stehling, R. Wittkowski, J. Ivaska, and T. Betz, *Pressure drives rapid burst-like coordinated cellular motion from 3D cancer aggregates*, *Advanced Science* **9**, 2104808 (2022). DOI: 10.1002/advs.202104808.
- [8] J. Voß and R. Wittkowski, *Orientation-dependent propulsion of triangular nano- and microparticles by a traveling ultrasound wave*, *ACS Nano* **XX**, XXX (2022). DOI: 10.1021/acsnano.1c02302.

Press reports: EurekaAlert!, Informationsdienst Wissenschaft, University of Münster.

- [9] M. te Vrugt, S. Hossenfelder, and R. Wittkowski,
Mori-Zwanzig formalism for general relativity: a new approach to the averaging problem,
Physical Review Letters **127**, 231101 (2021). DOI: 10.1103/PhysRevLett.127.231101.

Press reports: EurekaAlert!, Frankfurt Institute for Advanced Studies, Informationsdienst Wissenschaft, Innovations-Report, Münsterland Zeitung, N+1, Phys.org, Popmech, Pro-Physik.de, Sciencesprings, SciTechDaily, Space Daily, Tech Explorist, University of Münster.

- [10] A. P. Solon, J. Stenhammar, R. Wittkowski, M. Kardar, Y. Kafri, M. E. Cates, and J. Tailleur,
Pressure and phase equilibria in interacting active Brownian spheres,
Physical Review Letters **114**, 198301 (2015). DOI: 10.1103/PhysRevLett.114.198301.

Featured in *Physics*. Editors' Suggestion. Selected for a Viewpoint in PRL.

b) Patent application

- [1] R. Wittkowski [inventor], University of Münster [applicant],
Vorrichtung und Verfahren zum Sortieren von Partikeln mittels Strahlung.
German Patent and Trade Mark Office, patent pending, 2019.

Münster, March 2022

Raphael Wittkowski