

Ben F. Maier — CV

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Researcher Profile

I am a trans-disciplinary researcher focusing on understanding the fundamental mechanisms that determine how our social interactions facilitate the spread of infectious diseases and consequently, how we can mitigate their dispersal. Originally being trained in statistical physics, I employ methods from non-linear dynamics, complexity science, data science, and statistics incl. machine learning.

During the last years, I was able to contribute to Germany's response to the COVID-19 pandemic by conducting infectious disease modeling research at Robert Koch Institute. At the moment, I hold a postdoc position at DTU Copenhagen and Danmarks Statistik to research how socio-economical factors determine individual health from large-scale public data sets.

I am interested in finding new ways to collect and analyze social behavioral and epidemiological data to improve predictions of infectious disease outbreaks and facilitate decision-making for rapid responses. My aim is to establish "complex systems" methods in public health contexts by teaching students as well as collaborating in joint social/health research ventures.

Academic Positions

Postdoc

since 2022, *DTU Copenhagen, PI: Sune Lehmann*

Modeling of temporal network dynamics and big-data analyses of nation-scale social systems with machine-learning techniques.

Postdoc / Deputy PI

2020–2022, *Robert Koch Institute, PI: Dirk Brockmann*

Research focusing on epidemic spreading processes in human systems, mainly infectious disease modeling and data analysis regarding the COVID-19 pandemic. Supervising students and research projects. Reporting to crisis response panel and German ministry of health. Administrative tasks.

Scientific Work

Publications (co-)author of 19 articles (see section "Publications" below)

Talks presenter at 25 events (see section "Talks" below)

Reviews I reviewed manuscripts for PNAS, Science Advances, Communications Medicine, Physical Review X, PLOS Digital Health, PLOS ONE, Physical Biology, Physica A, Physical Review E, Nature Computational Science, JMIR Public Health and Surveillance, and Journal of Complex Networks.

PhD Thesis Spreading processes in human systems (2019), doi:10.18452/20950.

Education

- 2014–2019 **PhD in Theoretical Physics** *Humboldt University of Berlin, Robert Koch Institute, final grade: summa cum laude (highest possible grade)*
- 2011–2014 **MSc in Physics** *Humboldt University of Berlin, final grade: 1.2, thesis: 1.0 (highest possible grade)*
- 2011–2012 **Erasmus exchange program** *Universiteit Utrecht (NL), ten-month visit*
- 2008–2011 **BSc in Physics** *Humboldt University of Berlin, final grade: 1.7, thesis: 1.0 (highest possible grade)*
- 2008 **Abitur (German high school diploma)** *Berlin, final grade: 1.2, intensive courses: physics, computer science*

Additional Work Experience

- 2019 **Full-Stack Developer** *Robert Koch Institute, Conceptualization, implementation, and deployment of an internal web-application to improve data management and work flows (based on Django 2, JavaScript, MySQL 8)*
- 2015–2022 **Scientific Consultant / Data Scientist** *Self-employed, customers include e.g. Universal Music Germany and the Santa Fe Institute*
- 2010–2011 **Student Assistant** *Institute for Scientific Instruments (Berlin-Adlershof), Software development (C++)*
- 2010 **Research Intern** *HU Berlin, Department of Physics, Group "PHÄ", Research internships in lattice gauge theory*

Teaching

- since 2016 **Co-Supervisor** *RKI, HU Berlin & DTU, co-supervision of several Master and PhD students*
- 2018 **Teaching Assistant** *Santa Fe Insitute, "introduction to Dynamical Systems" on the MOOC-platform "Complexity Explorer"*
- 2016 **Teacher** *Deutsche SchülerAkademie, three-week course on "Network Science and Complex Systems" in a summer school for gifted high-school students*
- 2013–2014 **Teaching Assistant** *Department of Physics (HU Berlin), course: "Classical Mechanics and Introduction to Thermodynamics"*
- 2013 **Teacher** *Student association physics (HU Berlin), lectures in a prep course for the course "Computational Physics"*
- 2010–2011 **Teaching Assistant** *Charité (joint Department of Medicine HU Berlin & FU Berlin), introductory lab class in physics for freshmen in medicine*
- 2009 **Teacher** *Student association physics (HU Berlin), lectures in a prep course for freshmen in physics*

Fellowships & Awards

- since 2019 **Add-on Fellow for Interdisciplinary Life Science of the Joachim Herz Stiftung**
- 2014 **HU Berlin Research Track scholarship**
- 2011–2014 **Fellow of the German National Academic Foundation (Studienstiftung des Deutschen Volkes) including scholarship**
- 2008 **Award for excellent performance in the Abitur exam (Deutsche Physikalische Gesellschaft)**
- 2007 **Award for excellent performance in the physics intensive course (Deutsche Physikalische Gesellschaft)**

Theses

- 2019 Spreading Processes in Human Systems (PhD), doi:10.18452/20950.
- 2014 Thermophoresis in Liquids and its Connection to Equilibrium Quantities (MSc), doi:10.18452/21036.
- 2011 Simulations of Dyon Configurations in SU(2) Yang-Mills Theory (BSc), doi:10.18452/21035.

Technical Skill Set

Scientific	Numpy, Scipy, Matlab, Mathematica, Sun Grid Engine, Polars (Pandas alternative)
Development	Python, C++, JavaScript, bash, various SQL dialects
OSes	Linux incl. server administration (Ubuntu, Red Hat, CentOS), Mac OSx, Windows
Web	d3.js, Phaser.js, Three.js, p5.js, HTML, CSS, django
APIs	Twitter, Spotify, Wikipedia
Office	LaTeX, MS Word, MS Excel, Keynote, Pages
Graphic design	Affinity Designer, Affinity Photo, Autodesk Graphic, Gimp, InkScape
Audio & Music	Ableton Live 11, Maschine 2, Reason 8, Audacity, Foxdot, Sonic Pi

Languages

German	mother tongue
English	fluent (TOEFL-certified)
French	basic (level A2)

Schools

2015–2019	Member of the HU Berlin IRI Life Sciences Graduate School <i>Berlin</i>
2018	Complex Systems Summer School <i>Santa Fe Institute</i>
2017–2018	Specialization "Deep Learning" <i>coursea.org</i>
2015	Seminar "Time-Management" <i>Humboldt Graduate School Berlin</i>
2015	Member of the Humboldt Graduate School <i>Berlin</i>
2015	Complex Networks: Theory, Methods and Applications <i>Lake Como School of Advanced Studies in Complex Systems</i>

Publications

- 2023 **Estimating the share of SARS-CoV-2-immunologically naïve individuals in Germany up to June 2022**, B. F. Maier*, A. H. Rose, A. Burdinski, P. Klamser, H. Neuhauser, O. Wichmann, L. Schaade, L. H. Wieler, D. Brockmann
Epidemiology & Infection. doi:10.1017/S0950268823000195.
- Modeling the impact of the Omicron infection wave in Germany**, B. F. Maier*, A. Burdinski, M. Wiedermann, M. an der Heiden, T. Harder, O. Wichmann, F. Schlosser, D. Brockmann
Biology: Methods & Protocols. doi:10.1093/biomethods/bpad005.
- 2022 **Enhancing global preparedness during an ongoing pandemic from partial and noisy data**, P. Klamser*,

V. d'Andrea, F. di Lauro, A. Zachariae, S. Bontorin, A. di Nardo, M. Hall, B. F. Maier, L. Ferretti,
D. Brockmann, M. de Domenico
medRxiv. doi:10.1101/2022.08.19.22278981.

Evidence for positive long-and short-term effects of vaccinations against COVID-19 in wearable sensor metrics—Insights from the German Corona Data Donation Project, M. Wiedermann*, A. H. Rose.,
B. F. Maier, Jakob J. Kolb, D. Hinrichs, D. Brockmann
arXiv. arXiv:2204.02846.

Germany's fourth COVID-19 wave was mainly driven by the unvaccinated, B. F. Maier*,
M. Wiedermann, A. Burdinski, P. Klamser, M. A. Jenny, C. Betsch, D. Brockmann
Nature Communications Medicine. doi:10.1038/s43856-022-00176-7.

Understanding the impact of digital contact tracing during the COVID-19 pandemic, A. Burdinski*,
D. Brockmann, B. F. Maier*
PLOS Digital Health. doi:10.1017/S0950268823000195.

2021 **epipack: An infectious disease modeling package for Python**, B. F. Maier*
Journal of Open Source Software. doi:10.21105/joss.03097.

Potential benefits of delaying the second mRNA COVID-19 vaccine dose, B. F. Maier*, A. Burdinski,
A. H. Rose, F. Schlosser, D. Hinrichs, C. Betsch, L. Korn, P. Sprengholz, M. Meyer-Hermann, T. Mitra,
K. Lauterbach, D. Brockmann
arXiv. arXiv:2102.13600.

2020 **Effective containment explains subexponential growth in recent confirmed COVID-19 cases in China**,
B. F. Maier*, D. Brockmann
Science. doi:10.1126/science.abb4557.

COVID-19 lockdown induces structural changes in mobility networks — Implication for mitigating disease dynamics, F. Schlosser*, B. F. Maier, D. Hinrichs, A. Zachariae, D. Brockmann
PNAS. doi:10.1073/pnas.2012326117.

Thresholding normally distributed data creates complex networks, G. T. Cantwell*, Y. Liu, B. F. Maier*,
A. C. Schwarze, C. A. Serván, J. Snyder, G. St-Onge
Phys. Rev. E. doi:10.1103/PhysRevE.101.062302.

Commentary: A network science summer course for high school students, F. Klimm*, B. F. Maier*
Network Science. doi:10.1017/nws.2020.12.

Combining clinical epidemiology, NGS-based analysis and modeling approaches to reveal transmission dynamics of vancomycin-resistant enterococci in a high risk population within a tertiary care hospital, B. Neumann*, J. K. Bender, B. F. Maier, A. Wittig, S. Fuchs, T. Semmler, D. Brockmann,
H. Einsele, S. Kraus, L. H. Wieler, U. Vogel, G. Werner
PLOS ONE. doi:10.1371/journal.pone.0235160.

2019 **Netwulf: Interactive visualization of networks in Python**, U. Aslak*, B. F. Maier*
Journal of Open Source Software. doi:10.21105/joss.01425.

Generalization of the small-world effect on a model approaching the Erdős-Rényi random graph,
B. F. Maier*
Nature Scientific Reports. doi:10.1038/s41598-019-45576-3.

Modular hierarchical and power-law small-world networks bear structural optima for minimal first passage times and cover time, B. F. Maier*, C. Huepe, D. Brockmann
Journal of Complex Networks. doi:10.1093/comnet/cnz010.

2017 **Cover time for random walks on arbitrary complex networks**, B. F. Maier*, D. Brockmann
Phys. Rev. E. doi:10.1103/PhysRevE.96.042307.

2013 **Application of Ewald's Method for Efficient Summation of Dyon Long-Range Potentials**, B. Maier*,
F. Bruckmann, S. Dinter, E. M. Ilgenfritz, M. Müller-Preußker, M. Wagner
PoS Confinement. doi:10.22323/1.171.0051.

2012 **Confining dyon gas with finite-volume effects under control**, F. Bruckmann*, S. Dinter, E. M. Ilgenfritz,

Talks

- 2022 **COVID-19: Is simpler better?** COVID Crisis Lab – Seminar Series (invited), *Bocconi University Milan* (online presentation)
- Mobility and the spread of infectious diseases** Course: Fighting Infectious Diseases (guest lecture), *DTU*
- Modeling COVID-19 at RKI** Statistics/R-Seminar (invited), *Robert Koch Institute* (online presentation)
- Infectious-disease models: Types and theory** Summer School "Modellierung schwerer Infektionskrankheiten" (invited), *University of Halle*
- The role of complexity science and mathematical modeling in fighting the pandemic** Ising Lectures 2022 (invited), *ICMP NAS of Ukraine, Lviv* (online presentation)
- 2021 **Fighting the pandemic with complexity science** Davis Complexity Group Seminar (invited), *UC Davis* (online presentation)
- Temporal networks, modeling infectious diseases, interactive visualizations, and other fancy buzzwords: Three Python packages that might make your life easier** Networks 2021, HONS2021 Satellite (invited), *Washington, D.C.* (online presentation)
- 2020 **Epidemiologische Modelle sind was für die Profis - oder?** SciCAR conference, *Technical University of Dortmund* (online presentation)
- Signaling on modular hierarchical and other small-world networks** NetSci, *Rome* (online presentation)
- Misconceptions of spreading processes in sparse temporal networks** PIK, RD4 seminar series, *Potsdam*
- 2019 **Epidemic spreading on face-to-face temporal networks** SFI Seminar series, *Santa Fe*
- Flockworks: A class of dynamic network models for face-to-face interactions** CompleNet, *Tarragona*
- Tacoma: A C++/Python package for temporal network analysis** CompleNet, *Tarragona*
- 2018 **Flockworks: A class of dynamic network models for face-to-face interactions** Conference on Complex Systems, *Thessaloniki*
- When you're sick, please stay at home—Making sense of spreading phenomena using human mobility and contact data** "idalab" company seminar (invited), *Berlin*
- Flockworks: A class of dynamic network models for face-to-face interactions** DPG Spring Meeting, *Berlin*
- 2017 **Flockworks: A class of dynamic network models for face-to-face interactions** Group seminar DTU COMPUTE, *Copenhagen*
- Influence of group-structured network topologies on dynamical processes** Princeton-Humboldt cooperation workshop CoCCoN, *Princeton*
- 2016 **Influence of group-structured network topologies on dynamical processes** "Biophysics and Evolutionary Dynamics" Gruppenseminar UC Berkeley, *Berkeley*
- Flockworks: A class of dynamic network models for face-to-face interactions** NetSci, *Seoul*
- Flockworks: A class of dynamic network models for face-to-face interactions** Network Journal Club, *Oxford*
- 2015 **Modular hierarchical random networks—Topology and Dynamics** NetSci, *Zaragoza*
- 2012 **Application of Ewald's Method for Efficient Summation of Dyon Long-Range Potentials** Confinement X, *Munich*
- Confining dyon gas with finite-volume effects under control** DPG Spring Meeting, *Göttingen*
- 2011 **Simulations of dyon configurations in SU(2) Yang-Mills theory** DPG Spring Meeting, *Karlsruhe*

Open-Source Software

- **epipack**, Build epidemiological models for analytical and numerical analyses as well as network simulations, github.com/benmaier/epipack
- **netwulf**, Interactive visualizations of networks, github.com/benmaier/netwulf
- **tacoma**, C++ and Python package for the analysis and simulation of temporal networks in continuous time, github.com/benmaier/tacoma
- **cMHRN**, fast creation of modular-hierarchical, power-law, and regular small-world networks, github.com/benmaier/cMHRN
- **QSuite**, a command-line interface for efficient management and analysis of simulations on compute clusters, github.com/benmaier/qsuite
- **binpacking**, optimal distribution of weights to containers, github.com/benmaier/binpacking
- **EffectiveDistance**, computing the effective distance of spreading processes in transport networks, github.com/benmaier/effective-distance
- **RadialDistanceLayout**, radial visualization of a shortest-path tree with respect to the effective distance, github.com/benmaier/radial-distance-layout
- **NetworkProperties**, collection of useful network analysis methods, github.com/benmaier/network-properties
- **nwDiff**, Python package for the simulation and analysis of diffusion processes in complex networks, github.com/benmaier/nwDiff
- **cNetworkDiff**, C++-based packaged for the simulation and analysis of diffusion processes in complex networks, github.com/benmaier/cNetworkDiff
- **fisheye**, JavaScript library for local magnification of data in visualizations, github.com/benmaier/fisheye, see also: beta.observablehq.com/@benmaier/a-visually-more-appealing-fisheye-function
- **GTOM**, Python package for computing the "general topological overlap measure" of potentially very large networks, github.com/benmaier/GTOM
- **species-overlap**, Fast evaluation of incidence- and abundance-based species overlap measures, github.com/benmaier/species-overlap
- **quasispycies**, Classes to compute the stable equilibrium of the quasispecies-equation on complex networks, github.com/benmaier/quasispycies

Press Coverage

- May 2022 **Covid-19: Wie viele Deutsche noch ungeschützt sind**
Süddeutsche.de, newspaper article
- RKI zu Corona: 7 Prozent weder geimpft noch genesen**
DIE WELT, newspaper article
- RKI geht von 5,8 Millionen Ungeschützten aus**
n-tv.de, magazine article
- Neue RKI-Modellierung: So viele Deutsche sind schon geimpft oder genesen**
FOCUS Online, magazine article
- Fast sechs Millionen Deutsche ohne Immunität gegen Corona**
MDR.de, magazine article
- Neue Daten zeigen: Wie viele Menschen in Deutschland keinen Schutz gegen Corona haben**
DER MERKUR, magazine article
- RKI zu Corona: 7 Prozent weder geimpft noch genesen**
morgenpost.de, magazine article
- Mar 2022 **Corona-Lockerungen trotz hoher Inzidenzen: Wie passt das zusammen?**
NDR, magazine article

Feb 2022	<p>RKI-Modellierung der Omikron-Welle: Mitte Februar könnten die Fallzahlen wieder sinken <i>DER SPIEGEL</i>, magazine article</p> <p>Corona: Überlastung unwahrscheinlich, aber nicht ausgeschlossen <i>Die Zeit</i>, newspaper article</p> <p>Omikron: 300.000 Neuinfektionen pro Tag zu erwarten <i>NDR</i>, magazine article</p> <p>RKI legt Modellierungen zu möglichen Verläufen vor <i>Süddeutsche.de</i>, magazine article</p> <p>Wie sich die Omikron-Welle in Deutschland entwickeln könnte <i>ZDF</i>, magazine article</p> <p>Lockern oder Lockdown? <i>Süddeutsche.de</i>, magazine article</p> <p>RKI stellt Modellrechnungen vor: Wie die Omikron-Welle verlaufen könnte <i>RP ONLINE</i>, magazine article</p> <p>RKI legt Modellierungen zu möglichen Verläufen vor <i>Berliner Morgenpost</i>, newspaper article</p> <p>RKI-Modell rechnet mit 300.000 Omikron-Fällen pro Tag <i>Forschung & Wissen</i>, magazine article</p> <p>Ist die Omikron-Welle Ende Februar vorbei – und ein Corona-Exit denkbar? <i>Ruhr Nachrichten</i>, magazine article</p> <p>Coronavirus: RKI legt Modelle zu möglichen Verläufen der Omikron-Welle vor <i>stuttgarter-zeitung.de</i>, newspaper article</p> <p>RKI wagt Omikron-Ausblick: Erneuter Lockdown könnte alles nur noch schlimmer machen <i>FOCUS Online</i>, magazine article</p> <p>RKI hält bis zu 300.000 Neuinfektionen für möglich <i>n-tv.de</i>, magazine article</p> <p>Weitere Omikron-Welle bis April? Neues RKI-Modell liefert bittere Prognose <i>inFranken.de</i>, newspaper article</p>
Jul 2021	<p>Herd Immunity: Is This How the Pandemic Comes to an End? <i>Die Zeit</i>, newspaper article</p>
Jun 2021	<p>Herdenimmunität: Endet so die Pandemie? <i>Die Zeit</i>, newspaper article</p>
Mar 2021	<p>Drei Ideen, um die Pandemie besser in den Griff zu kriegen <i>rbb24</i>, newspaper article</p> <p>Dritte Welle: Längere Impfintervalle würden Tausende Leben retten <i>DIE WELT</i>, newspaper article</p> <p>Simulationsrechnung: So lässt sich die dritte Corona-Welle brechen <i>nordbayern.de</i>, magazine article</p> <p>Lauterbach hält Änderung der Impfstrategie für dringend nötig <i>Der Tagesspiegel</i>, newspaper article</p>
Feb 2021	<p>Corona: So sinnvoll sind Grenzsicherungen zu Tschechien und Österreich <i>DER SPIEGEL</i>, magazine article</p> <p>Wieso die Fallzahlen steigen und Social Distancing hilft <i>rbb24</i>, newspaper article</p> <p>Zu viele Hoffnungen und absurde Zweifel an neuen Tests <i>rbb24</i>, newspaper article</p>

	Warum die Berliner Amtsärzte richtig argumentieren - aber falsche Schlüsse ziehen <i>rbb24</i> , newspaper article
	Corona-Strategie von Karl Lauterbach: So will er die dritte Welle brechen <i>DER SPIEGEL</i> , magazine article
	Lauterbach schlägt neue Impf- und Teststrategie vor <i>BSAktuell</i> , newspaper article
Jun 2020	Schneller als das Virus <i>ARTE Re:</i> , TV broadcast
May 2020	Corona-Leitfaden: Diese Zahlen helfen Ihnen, die Pandemie zu verstehen <i>DIE WELT</i> , newspaper article
	"Eine Vorhersage würde ich für maximal sechs Tage wagen" <i>Welt am Sonntag</i> , newspaper article
	Die Zahlen der Pandemie <i>Welt am Sonntag</i> , newspaper article
	Tracking quarantine movement <i>Deutsche Welle: "Science Unscripted"</i> , podcast
	Die Pandemie <i>Gemeinsam gegen Corona - der Wissenspodcast von GEOlino</i> , podcast
Apr 2020	Gut gemeint ist nicht immer gut gemacht: Richtig helfen in der Corona-Krise <i>Deutschlandfunk Nova</i> , radio broadcast
	Warum Abstand halten an Ostern gegen die Pandemie helfen kann <i>rbb24</i> , magazine article
	Lockerung des Lockdowns: So groß ist die Gefahr der zweiten Welle <i>DIE WELT</i> , newspaper article
	Corona ist ein Marathon, kein Sprint <i>rbb24</i> , magazine article
	The Effects of Physical Isolation on the Pandemic Quantified <i>The Scientist Magazine</i> , magazine article
	Coronavirus: China got it right by locking down Wuhan, German study says <i>South China Morning Post</i> , newspaper article
	Bleibt zu Hause! <i>Laborjournal</i> , newspaper article
	Einkaufen für Nachbarn? Richtig helfen in Corona-Zeiten <i>FIT FOR FUN</i> , magazine article
Mar 2020	How the Virus Got Out <i>The New York Times</i> , newspaper article
	Coronavirus curve shows much of Europe could face Italy-like surge within weeks <i>The Washington Post</i> , newspaper article
	Epidemiological models show Europe faces Italy-like coronavirus surges within weeks <i>The Independent</i> , newspaper article
	Nachbarschaftshilfe: "Nicht einfach draufloshelfen" <i>Die Zeit</i> , newspaper article
	"Es kann nicht sein, dass Impfstoff liegen bleibt" <i>Süddeutsche Zeitung</i> , newspaper article
	Solidarität: Richtig helfen in der Corona-Krise <i>NDR</i> , radio broadcast

Nicht drauflos helfen

neues deutschland, newspaper article

Distanz und Nähe

neues deutschland, newspaper article

Veći dio Evrope može zadesiti scenarij iz Italije

Radio Televizija BN, newspaper article

Advierten que en pocas semanas toda Europa puede estar como Italia

La Nación, newspaper article

Prognoze epidemiologa: Veći dio Evrope za nekoliko sedmica će zadesiti italijanski scenarij

Klix.ba, newspaper article

COVID-19. Europa à beira de se tornar uma gigantesca Itália

Rádio e Televisão de Portugal, newspaper article

Scholz will Strategiewechsel bei Corona-Politik

fuldainfo.de, magazine article