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 Statistiks 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 behavorial 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 respsonse 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 Publich 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** *Berlin*

2018 **Complex Systems Summer School** *Santa Fe Institute*

2017–2018 **Specialization "Deep Learning"** *coursera.org*

2015 **Seminar "Time-Management"** *Humboldt Graduate School Berlin*

2015 **Member of the Humboldt Graduate School** *Berlin*

2015 **Complex Networks: Theory, Methods and Applications** *Lake Como School of Advanced Studies in Complex Systems*

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 **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.

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.

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,

B. Maier, M. Müller-Preußker, M. Wagner*
Phys. Rev. D. doi:10.1103/PhysRevD.85.034502.

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 **RKI-Modellierung der Omikron-Welle: Mitte Februar könnten die Fallzahlen wieder sinken**
DER SPIEGEL, magazine article

Corona: Überlastung unwahrscheinlich, aber nicht ausgeschlossen
Die Zeit, newspaper article

Omikron: 300.000 Neuinfektionen pro Tag zu erwarten
NDR, magazine article

RKI legt Modellierungen zu möglichen Verläufen vor
Süddeutsche.de, magazine article

Wie sich die Omikron-Welle in Deutschland entwickeln könnte
ZDF, magazine article

Lockern oder Lockdown?
Süddeutsche.de, magazine article

RKI stellt Modellrechnungen vor: Wie die Omikron-Welle verlaufen könnte
RP ONLINE, magazine article

RKI legt Modellierungen zu möglichen Verläufen vor
Berliner Morgenpost, newspaper article

RKI-Modell rechnet mit 300.000 Omikron-Fällen pro Tag
Forschung & Wissen, magazine article

Ist die Omikron-Welle Ende Februar vorbei – und ein Corona-Exit denkbar?
Ruhr Nachrichten, magazine article

Coronavirus: RKI legt Modelle zu möglichen Verläufen der Omikron-Welle vor
stuttgarter-zeitung.de, newspaper article

RKI wagt Omikron-Ausblick: Erneuter Lockdown könnte alles nur noch schlimmer machen
FOCUS Online, magazine article

RKI hält bis zu 300.000 Neuinfektionen für möglich
n-tv.de, magazine article

Weitere Omikron-Welle bis April? Neues RKI-Modell liefert bittere Prognose
inFranken.de, newspaper article

Jul 2021 **Herd Immunity: Is This How the Pandemic Comes to an End?**
Die Zeit, newspaper article

Jun 2021 **Herdenimmunität: Endet so die Pandemie?**
Die Zeit, newspaper article

Mar 2021 **Drei Ideen, um die Pandemie besser in den Griff zu kriegen**
rbb24, newspaper article

Dritte Welle: Längere Impfintervalle würden Tausende Leben retten
DIE WELT, newspaper article

Simulationsrechnung: So lässt sich die dritte Corona-Welle brechen
nordbayern.de, magazine article

Lauterbach hält Änderung der Impfstrategie für dringend nötig
Der Tagesspiegel, newspaper article

Feb 2021 **Corona: So sinnvoll sind Grenzschließungen zu Tschechien und Österreich**
DER SPIEGEL, magazine article

Wieso die Fallzahlen steigen und Social Distancing hilft
rbb24, newspaper article

Zu viele Hoffnungen und absurde Zweifel an neuen Tests
rbb24, newspaper article

Warum die Berliner Amtsärzte richtig argumentieren - aber falsche Schlüsse ziehen
rbb24, newspaper article

Corona-Strategie von Karl Lauterbach: So will er die dritte Welle brechen
DER SPIEGEL, magazine article

Lauterbach schlägt neue Impf- und Teststrategie vor
BSAktuell, newspaper article

Jun 2020 **Schneller als das Virus**
ARTE Re:, TV broadcast

May 2020 **Corona-Leitfaden: Diese Zahlen helfen Ihnen, die Pandemie zu verstehen**
DIE WELT, newspaper article

"Eine Vorhersage würde ich für maximal sechs Tage wagen"
Welt am Sonntag, newspaper article

Die Zahlen der Pandemie
Welt am Sonntag, newspaper article

Tracking quarantine movement
Deutsche Welle: "Science Unscripted", podcast

Die Pandemie
Gemeinsam gegen Corona - der Wissenspodcast von GEOlino, podcast

Apr 2020 **Gut gemeint ist nicht immer gut gemacht: Richtig helfen in der Corona-Krise**
Deutschlandfunk Nova, radio broadcast

Warum Abstand halten an Ostern gegen die Pandemie helfen kann
rbb24, magazine article

Lockerung des Lockdowns: So groß ist die Gefahr der zweiten Welle
DIE WELT, newspaper article

Corona ist ein Marathon, kein Sprint
rbb24, magazine article

The Effects of Physical Isolation on the Pandemic Quantified
The Scientist Magazine, magazine article

Coronavirus: China got it right by locking down Wuhan, German study says
South China Morning Post, newspaper article

Bleibt zu Hause!
Laborjournal, newspaper article

Einkaufen für Nachbarn? Richtig helfen in Corona-Zeiten
FIT FOR FUN, magazine article

Mar 2020 **How the Virus Got Out**
The New York Times, newspaper article

Coronavirus curve shows much of Europe could face Italy-like surge within weeks
The Washington Post, newspaper article

Epidemiological models show Europe faces Italy-like coronavirus surges within weeks
The Independent, newspaper article

Nachbarschaftshilfe: "Nicht einfach draufloshelfen"
Die Zeit, newspaper article

"Es kann nicht sein, dass Impfstoff liegen bleibt"
Süddeutsche Zeitung, newspaper article

Solidarität: Richtig helfen in der Corona-Krise
NDR, 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