

## PhD project - Data-driven Agent-based modelling for infectious diseases

You want to apply your data science knowledge to the basic research questions and societal challenges of our modern world? Our scientists in HDS-LEE address some of the most pressing issues of our time, such as energy transition, climate change and resource scarcity, brain function, drug design, identification of diseases at very early stages.

As Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE), we aim to educate and train the next generation of data scientists during their doctoral thesis in close contact to domain-specific knowledge and research in three application domains: Life and medical science, earth science, energy systems and material science. Visit HDS-LEE at: <https://www.hds-lee.de/>

The German Aerospace Center (DLR) is the national aeronautics and space research center of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport, digitalization and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space program. DLR is also the umbrella organization for the nation's largest project management agency.

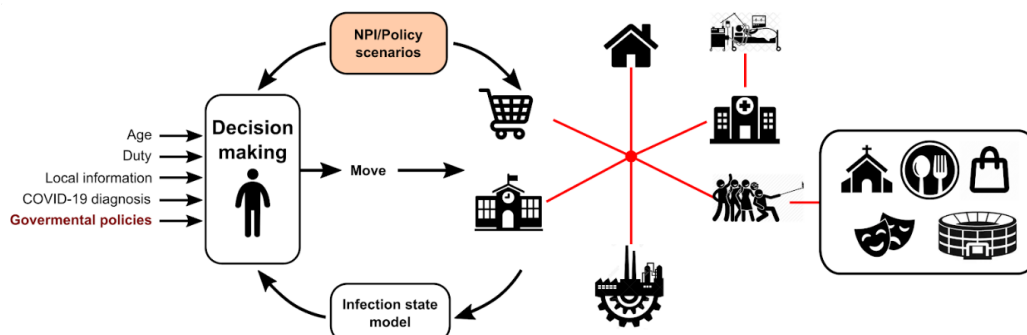
The High-Performance Computing department of the DLR Institute for Software Technology (SC-HPC) is cooperating with other institutes of DLR and external partners especially on the following topics:

- Parallel Algorithms and Data Structures,
- Mathematical Modelling and Scalable Simulation Software,
- Parallelization Techniques for Modern Computer Architectures,
- High-Performance Data Analytics, and
- Quantum Computing.

We are looking for a **PhD-student (f/m/d)** in data-driven numerical simulation to work within a project linked to the "Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE)". The successful candidate will investigate data-driven agent-based models for the dynamics of infectious diseases, and their comparison with other approaches.

### Project overview

Agent-based models (ABMs) are used in a variety of scientific domains like social sciences, economics, physics, biology, or epidemiology to name just a few. As many infectious diseases are transmitted by human-to-human interaction, ABMs serve as a natural way to describe the spread of the disease in a community. In this thesis, ABMs shall not only be applied for infectious diseases but also address several open research questions with respect to model validation and uncertainty analysis. The goal is to improve model quality and to accelerate the simulation process by the combination of classical numerical or statistical models with models generated by machine learning methods. By the analysis of ABMs and their comparison to classical approaches, ABMs become more reliable and transparent and can be used to the best of their advantage in the future.



### Your Job

- Analyze stochastic modelling approaches for the spread of infectious diseases with their potential advantages and disadvantages for modelling and analysis
- (Co)-Implement an open-source agent-based model
- Collect and explore new data sets that can improve data-driven agent-based models
- Apply machine learning for investigating the model's behavior and parameter space
- Investigate the performance of the model and apply parallelization approaches

### Your Profile

- You have a high interest to apply your data science knowledge to medicine
- University degree in either computational engineering science, computer science, applied mathematics, data sciences, simulation sciences, or physics
- Good experience with numerical simulation
- Good Programming skills in Python and C++
- Experience with stochastic processes, Monte Carlo algorithms, machine learning methods or uncertainty analysis is advantageous.
- Good experience with parallel computing is a clear advantage.
- Experience with agent-based models is advantageous.
- Ability to work independently as well as collaboratively in an international, interdisciplinary team; good communication and organizational skills
- Very good command of the English language (TOEFL or equivalent evidence)
- High level of scholarship as indicated by bachelor and master study transcripts and two reference letters

### Our Offer

The HDS-LEE PhD position will be located at DLR in Cologne in the SC-HPC department. We offer you

- Outstanding scientific and technical infrastructure – ideal conditions for successfully completing a doctoral degree
- A highly motivated group as well as an international and interdisciplinary working environment
- Continuous scientific mentoring by your scientific advisors
- Chance of participating in (international) conferences
- Unique HDS-LEE graduate school program
- Qualification that is highly welcome in industry
- Further development of your personal strengths, e.g. via a comprehensive further training program

We offer you an exciting and varied role in an international and interdisciplinary working environment. The position is for a fixed term of 3 years. Your salary is in line with 100 % of pay group 13 of the Collective Agreement for the Public Service (TVöD).

Equal career prospects for women and men. We especially foster women in data science and offer individual career planning. We welcome applications from disabled persons.

Become a part of HDS-LEE.

Apply to and contact for further information: Dr.-Ing. Achim Basermann [Achim.Basermann@dlr.de](mailto:Achim.Basermann@dlr.de)

Apply until: 31<sup>th</sup> October 2021

Starting date: January to March 2022