

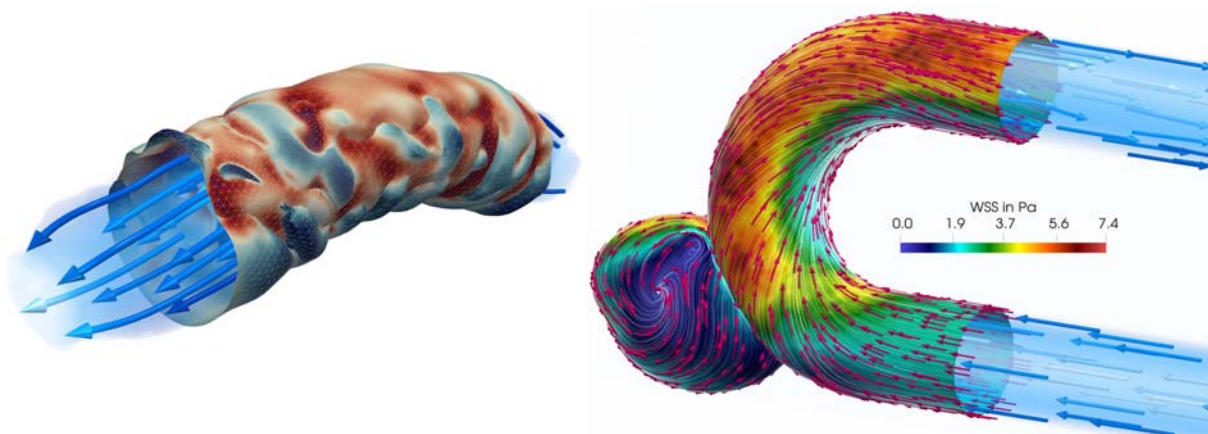
## PhD project *Blood Flow: Bridging the Micro-Macro Gap Using Scientific Machine Learning*

The Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE) provides an interdisciplinary environment for educating the next generation of data scientists in close contact to domain-specific knowledge and research. All three domains – life & medical sciences, earth sciences, and energy systems/materials – are characterized by the generation of huge heterogeneously structured data sets, which have to be evaluated in order to obtain a holistic understanding of very complex systems. Visit HDS-LEE at: [www.hds-lee.de](http://www.hds-lee.de)

HDS-LEE is an international graduate school in the Cologne-Düsseldorf-Aachen area of North-Rhine-Westphalia, Germany, as a cooperation between RWTH Aachen University, University of Cologne, University of Düsseldorf, German Aerospace Center (DLR), Max-Planck-Institut für Eisenforschung, and Forschungszentrum Jülich.

### Project overview

At the University of Cologne in the research group of Prof. Dr. Axel Klawonn, we are looking for a PhD student (d/f/m) in Applied Mathematics with a topic in Scientific Machine Learning to work within a project linked to the “Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE)”. The successful candidate will work on a multiscale blood flow simulation. Blood and blood flow play an essential role in the functioning of the human organism in health and disease. In particular, the cessation of bleeding after an injury (hemostasis), the formation of vascular plaques (thrombosis), and the flow disturbance after vascular alterations (aneurisms) or medical interventions (stents) are important conditions, where sophisticated simulations can significantly contribute to the improvement of treatment options. A major challenge for understanding and predicting such conditions is the tight coupling of various processes at the molecular and cellular level with the macroscopic flows in small and large blood vessels. No single simulation technique is able to cover the range of length scales from tens of nanometers to centimeters, so that a combination of different approaches is required. The project will be carried out in close cooperation with the group of Prof. Dr. Gerhard Gompper at the Forschungszentrum Jülich.



### Your Job

- Analyze and further improve homogenization methods for multiscale blood flow problems
- Develop a new data-driven scale bridging approach
- Combining high-performance computing and scientific machine learning approaches
- Implement new algorithms in a high-performance software environment
- Professional software development
- Performing and analyzing large-scale simulations on leading parallel supercomputers

### Your Profile

- University degree (M.Sc. or equivalent) in applied mathematics or in computational engineering science, computer science, simulation science with a strong background in applied mathematics
- Excellent programming skills in C/C++
- Good experience in machine learning and parallel computing
- Good knowledge of finite element methods
- Experience with deep learning frameworks, such as Tensorflow or Pytorch is advantageous.
- Ability to work independently as well as collaboratively in a team; good communication and organizational skills
- A high level of scholarship as indicated, for example, by bachelor and master study transcripts and two reference letters

### Our Offer

This HDS-LEE PhD position will be in the group of Prof. Dr. Axel Klawonn at the University of Cologne.

#### We offer

- A contract for three years
- Pay in line with 100 % of remuneration group 13 TV-L of the pay scale for the German public sector, if the applicant meets the relevant wage requirements and personal qualifications
- Unique HDS-LEE graduate school program
- A highly motivated group as well as an international and interdisciplinary working environment at one of Europe's largest research universities
- Outstanding scientific and technical infrastructure – ideal conditions for successfully completing a doctoral degree
- Chance of participating in (international) conferences
- Continuous scientific mentoring
- Further development of your personal strengths, e.g., via a comprehensive further training program

Further information on HDS-LEE is available at: [www.hds-lee.de](http://www.hds-lee.de)

Further information on the research group of Prof. Dr. Axel Klawonn is available at: [www.numerik.uni-koeln.de/en/](http://www.numerik.uni-koeln.de/en/)

The University of Cologne is committed to equal opportunities and diversity. Women are especially encouraged to apply and given priority in accordance with the Equal Opportunities Act of North Rhine-Westphalia (Landesgleichstellungsgesetz – LGG NRW). We also expressly welcome applications from people with disabilities / special needs or of equal status.

Become part of HDS-LEE.

Apply to and contact for further information: Prof. Dr. Axel Klawonn [applications\\_hdslee\\_2021@math.uni-koeln.de](mailto:applications_hdslee_2021@math.uni-koeln.de)

Apply until October 31, 2021

Starting date: March 1, 2022