Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Bio- and Geoscience, Agrosphere (IBG-3)

Supervising scientist: Dr. Roland Bol (main supervisor),
Prof. Dr. Andrea Schnepf (co-supervisor)

University for Registration: University of Bonn or Amsterdam (The Netherlands)

Research Project: Changed litter decomposition, carbon, nutrient cycling and stoichiometric relationships matter in a German forested mountainous headwater catchment five years after clearcut

Position: PhD Student ☑ Sandwich PhD Student ☐

Research Area:

The Wüstebach forested catchment is a small headwater catchment located in the Eifel National Park; it is part of the TERENO Lower Rhine Valley-Eifel field experimental observatory. In August to September 2013 a large clear-cut (9 ha) within the whole 38.5 ha catchment was undertaken. Over the last 4 to 5 years natural revegetation is re-establishing in these clear-cut areas. The proposed study will on a spatial explicit basis compare the humus, whole soil and vegetation rooting profiles in both the clear-cut and nearby areas which have not been reforested. Attention will be given to differential litter and root decomposition, soil carbon turnover, nutrient cycling and stoichiometric relationships (C, N, P, S) between both these areas. New field samples will be compared will be made to archived soil sample collected in 2013 (prior to clear-cut) and those from 2014 (1 year) and 2018 (5 years after clear-cut).

Specific Requirements:

Graduated in chemistry, biogeochemistry or environmental sciences. A background in forestry, soil science or hydrology is beneficial. Experience in with litter decomposition;

Soil root dynamics, carbon cycling, nutrient cycling, (stable) isotope analyses, as well as (hydrological) data analysis skills are beneficial. Experiences in designing experiments are a plus. Good knowledge of the English language. The thesis will be defended at the University of Bonn or University of Amsterdam.

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good knowledge of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Dr. Roland Bol, Forschungszentrum Jülich, Institute of Bio- and Geosciences (IBG-3), 52425 Juelich, Germany r.bol@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich – www.fz-juelich.de
Department/Institute: Institute of Bio- and Geosciences – Agrosphere (IBG-3)
Supervising scientist: Prof. Dr. Nicolas Brüggemann
University for Registration: University of Bonn
Research Field: Earth and Environment
Position: PhD Student X Sandwich PhD Student □
Research Project: The role of abiotic reactions in dinitrogen (N₂) formation in soil
Research Area:

Although dinitrogen (N₂) is an environmentally harmless substance, i.e. no reactive, toxic or greenhouse gas, N₂ fluxes constitute in many ecosystems the major loss of nitrogen from the system to the atmosphere. Classically, denitrification is considered as the only process generating N₂ naturally. Dinitrogen fluxes are very difficult to measure due to the very high atmospheric N₂ background. However, in those rare cases in which N₂ fluxes have been quantified, substantial N₂ fluxes have been found also under conditions that do not primarily favor denitrification, but rather nitrification or other aerobic processes involved in the soil N cycle. Therefore, it might be possible that also abiotic (chemical) reactions contribute substantially to N₂ formation in the soil. The aim of this PhD project is to elucidate the various chemical processes in the soil involving reactive nitrification intermediates, soil organic matter and proteins or peptides that might lead to the formation of N₂ under oxic soil conditions, i.e. in the presence of oxygen. This work will involve a range of laboratory incubation and field experiments with different soils and under different soil conditions as well as the use of a combination of stable isotope labeling with isotope-ratio mass spectrometry, GC-MS or py-FIMS techniques. A successful PhD-thesis will be defended at the University of Bonn, Germany.

Specific Requirements:

MSc in natural sciences (biology, chemistry, soil science or related subjects) or engineering (environmental engineering, agricultural engineering) with sound technical skills. Very good knowledge of English language is required. Experience in stable isotope analysis and/or GC or GC/MS measurements are desirable.

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor:
Prof. Dr. Nicolas Brüggemann, Forschungszentrum Jülich, Institute of Bio- and Geosciences – Agrosphere (IBG-3), 52425 Jülich, Germany
n.brueggemann@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH - www.fz-juelich.de

Department/Institute: Peter Grünberg Institute, Electronic Properties (PGI-6)
http://www.fz-juelich.de/pgi/pgi-6/EN/Home/home_node.html

Supervising scientist: PD Dr. Daniel E. Bürgler

University for Registration: University of Cologne

Research Field: Molecular Magnetism and Spintronics

Position: PhD Student X  Sandwich PhD Student □

Research Area:
Interest in magnetic properties of nanoscale structures is rapidly growing mainly driven by the advancing miniaturization in information technology. Understanding and control of individual electron spins opens a route towards nanospintronics and quantum computing, which could revolutionize future information technology. One promising approach is to employ single molecules adsorbed on surfaces, which exhibit magnetic properties either intrinsically or due to the interaction/hybridization with the substrate. The offered project focuses on spin-polarized scanning tunnelling microscopy and spectroscopy (SP-STM/STS) investigations aiming at a fundamental understanding of the magnetic properties of individual and self-assembled molecules on well-defined metal surfaces. The experiments will be conducted in an ultra-high vacuum (UHV) low-temperature STM operating in high magnetic fields. The project is embedded in a larger initiative on molecular spintronics that also comprises chemistry and theory groups performing adapted molecule synthesis and DFT calculations.

Specific Requirements:
The project is highly competitive as we strive for (i) bridging the gap in understanding between magnetotransport properties in mesoscopic junctions comprising organic layers and the microscopic electronic as well as magnetic properties of single adsorbed molecules studied by SP-STM and DFT calculations and (ii) integrating optical functionality into magnetic single molecules and organic layers by employing photo-induced electron transfer in donor-acceptor dyad molecules. Hence, we are searching for a highly-motivated PhD student, who wants to contribute to our cutting-edge research. Requirements are an above-average grade in Physics, good English skills, good knowledge of solid-state physics, possibly working experience in surface science (preferably STM), good interpersonal communication skills, and interest in working with state-of-the-art instrumentation in an interdisciplinary and international environment. For information about the institute, our instrumentation and research see http://www.fz-juelich.de/pgi/pgi-6/EN and Nat. Commun. 4, 2425 (2013), SPIN 4, 1440007 (2014), Phys. Rev. B 95, 094409 (2017), New. J. Phys. 19, 053016 (2017).

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor: Dr. Daniel E. Bürgler, Peter Grünberg Institute (PGI-6), Forschungszentrum, 52425 Jülich, Germany; d.buergler@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Neuroscience and Medicine, Medical Imaging Department (INM-3), www.fz-juelich.de/inm/inm-3/EN

Supervising scientists: Prof. Dr. Dr. K. Vogeley, Dr. J. Dammers

University for Registration: University of Cologne

Research Project: Uncover the brain dynamics of social information processing

Research Field: Neuroimaging, MEG/EEG data analysis, Psychology

Position: PhD Student X Sandwich PhD Student 

Research Area:
Over the last decade, cognitive neuroscience has started to systematically study the neural mechanisms of social information processing. Essentially, two different neural systems, which appear to be complementary, have been established in this research field, most likely to constitute two different routes of processing our social cognitive capacities in everyday social encounters. The project aims at uncovering the neural dynamics of the underlying network processing social information, including the analysis of the causal relationship of brain regions being involved. For this purpose, magnetoencephalography (MEG) provides excellent temporal resolution and allows to investigate slow and rapid interactions between functionally connected brain areas. The Institute of Neuroscience and Medicine at FZ Jülich provides a world-wide highly reputed research in neuroscience and a unique environment to support breakthrough discoveries. The successful applicant will participate in interdisciplinary research related to cognitive neuroscience and to the development and validation of new strategies in MEG data analysis.

Specific Requirements:
Desirable: Experience with MEG or EEG data acquisition and analysis.
Obligatory: Excellent educational records in the related field, good programming and data processing skills, time series analysis.
Desirable applicant’s background: Neuroscience, electrophysiology, physics, neuroscience and related. Good knowledge of English language

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: October 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of Supervisors: Prof. Dr. Dr. K. Vogeley (INM-3), Dr. J. Dammers (INM-4), Forschungszentrum Jülich, Institute of Neuroscience and Medicine (INM-3), 52425 Jülich, Germany, j.dammers@fz-juelich.de; kai.vogeley@uk-koeln.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Juelich GmbH – www.fz-juelich.de
Supervising scientist: Dr. Philipp Ebert
University for Registration: RWTH Aachen University
Research Field: Semiconductor surface science/Nanotechnology
Position: PhD Student X
Sandwich PhD Student □
Research Area:
Scanning tunneling microscopy and spectroscopy of non-polar ternary group III-nitride semiconductor surfaces

The development of novel semiconductor devices based on wurtzite structure group III nitrides cannot rely solely on the binary compounds, since only ternary (Al,Ga,In)N compounds offer the possibility to engineer the desired electronic/optoelectronic properties. In order to control device properties, a detailed microscopic and spectroscopic understanding of the fundamental properties and physics of the ternary (Al,Ga,In)N materials is necessary. Therefore, we propose to investigate basic properties of ternary group III nitride compound semiconductor non-polar surfaces using scanning tunneling microscopy and spectroscopy combined with high resolution transmission electron microscopy. With such a comprehensive understanding of the design of electronic/optoelectronic devices based on group III nitrides can be turned much more effective.

Specific Requirements:
Excellent English communication and writing skills
Material or solid state physics background
Interest in surface science techniques, in particular in scanning tunneling microscopy and spectroscopy
Ability to work in a team.

The RWTH Aachen University may require the successful participation at one solid state physics course over 1 year (depending on the actual degree earned and courses taken in China).

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Dr. Philipp Ebert, Peter Gruenberg Institut (PGI-5), Forschungszentrum Juelich GmbH, 52425 Juelich, Germany, p.ebert@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute for Neuroscience and Medicine, Brain and Behaviour (INM-7)
http://www.fz-juelich.de/inm/inm-7/EN/Home/home_node.html

Supervising scientist: Dr. Kaustubh Patil, Dr. Felix Hoffstaedter, Prof. Dr. Simon Eickhoff

University for Registration: Heinrich Heine University of Düsseldorf

Research Field: Neuroscience

Position: PhD Student ☑ Sandwich PhD Student ☐

Research Area: The scientific understanding of the human brain has improved substantially over the last decades, thanks to improved non-invasive data acquisition coupled with advanced data analysis methods. However, the biological relevance of idiosyncratic differences in individual pattern of brain structure and function remain poorly understood. This PhD work aims at furthering insights into the significance of individual signatures of structure and function of the brain by exploring the relationship between different modalities of brain data, e.g. structural and functional MRI, with regard to individual phenotypes and behavioral measures. The student will be involved in data processing and development of novel machine learning based methods to link and compare different imaging modalities and relate them to demographic and behavioral measures. The methods developed will then be applied to clinical samples on neurodegenerative diseases such as Alzheimer’s and Parkinson’s to evaluate the effect of pathology on structure function relationships.

A successful PhD thesis will be defended at Heinrich Heine University of Düsseldorf.

Specific Requirements:

- MSc or equivalent in a relevant field (Physics, Neuroscience, Applied Mathematics, Computer Science)
- Good knowledge of basics in both functional and structural brain imaging
- Good written and oral communication skills in English
- Programming experience (Python, MATLAB, C, C++)
- Experience with standard neuroimaging software packages (SPM, FSL, etc.) and with machine learning (classification and clustering) will be a plus

Duration of stay: 4 years

Work Place: Forschungszentrum Juelich, Germany (near Cologne)

Earliest Start: October 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered in parallel to the project.

Name and Address of the Supervisor: Forschungszentrum Jülich, Institute for Neuroscience and Medicine (INM-7), Dr. Felix Hoffstaedter, 52425 Jülich, Germany, (f.hoffstaedter@fz-juelich.de)
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute for Neuroscience and Medicine, Brain and Behaviour (INM-7)
http://www.fz-juelich.de/inm/inm-7/EN/Home/home_node.html

Supervising scientist: PD Dr. Oleksandr Popovych, Prof. Dr. Simon B. Eickhoff

University for Registration: Heinrich Heine University of Düsseldorf

Research Field: Neuroscience

Position: PhD Student X

Research Area: The human brain represents a highly complex network, which shows well-structured spatio-temporal dynamics even at a resting state. Data obtained from noninvasive neuroimaging (e.g. fMRI) allows to calculate functional connectivity that captures the interactions between different brain regions as well as their time evolution. Using this information collected in large cohorts together with a detailed structural connectivity from anatomical measurements (e.g. dMRI), we can develop and validate sophisticated whole-brain neural mass models which can well reproduce activity and connectivity of the resting states networks revealed from the measured data. These models can then be used to address mechanisms of brain dynamics. More specifically, a model-based investigation of the interdependence between brain activity and connectivity will be focused on how the corresponding model parameters and dynamics may be associated with healthy and diseased states (e.g. Parkinson’s disease, schizophrenia, etc.) or aging, which could be of clinical relevance. The model parameters and dynamics can further be utilized for a better description of the inter-individual variability (differences between subjects/patients) as well as for an advance in data processing and analysis tools.

A successful PhD thesis will be defended at Heinrich Heine University of Düsseldorf.

Specific Requirements:

- MSc or equivalent in a relevant field (Physics, Neuroscience, Applied Mathematics, Computer Science)
- Good knowledge of non-linear dynamical systems/computational neuroscience
- Good written and oral communication skills in English
- Programming experience (Python, MATLAB, C, C++)
- Previous experience on parallel computing and use of supercomputer environment would be considered a plus

Duration of stay: 4 years

Work Place: Forschungszentrum Juelich, Germany (near Cologne)

Earliest Start: October 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered in parallel to the project.

Name and Address of the Supervisor: PD Dr. Oleksandr Popovych, Forschungszentrum Jülich, Institute for Neuroscience and Medicine (INM-7), 52425 Jülich, Germany; o.popovych@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute for Neuroscience and Medicine, Brain and Behaviour (INM-7)
http://www.fz-juelich.de/inm/inm-7/EN/Home/home_node.html

Supervising scientist: PD Dr. Susanne Weis, Dr. Robert Langner, Prof. Dr. Simon Eickhoff

University for Registration: Heinrich Heine University of Düsseldorf

Research Field: Neuroscience

Position: PhD Student X  Sandwich PhD Student □

Research Area:
Sex differences in cognitive processing strategies have been well established, in particular with respect to the selectivity in allocating attentional resources. Given that the allocation of attention forms the basis for many other cognitive tasks (e.g. episodic and semantic memory, action control), a more comprehensive understanding of the neural basis of sex differences in attention has far-reaching implications, not only for healthy participants, but also for clinical conditions like ADHD or autism, where sex differences are reliably observed.

This PhD project will develop and conduct a large-scale, multi-modal brain imaging study to elucidate to what extent sex differences in different cognitive domains can be explained by differences in underlying attentional processes and their neural substrates. To disentangle the complexity of individual differences, the interaction of inter-individual (sex) and intra-individual (e.g. stress level, motivation, fatigue) variability in the allocation of attentional resources will also be taken into account. The envisaged multimodal imaging approach will integrate regional brain activation and morphology with measures of functional and structural connectivity. The integrative analysis of this very rich set of neuroimaging, behavioral, and self-report data will rely on classical statistical as well as recent machine-learning approaches to big data.

A successful PhD thesis will be defended at Heinrich Heine University of Düsseldorf.

Specific Requirements:

- MSc or equivalent in a relevant field (e.g. psychology, neuroscience, medicine)
- Good written and oral communication skills in English
- Basic written and oral communication skills in German, with a strong commitment to improving during the stay
- Knowledge in experimental design and/or statistical analyses
- Previous experience with behavioral and imaging data acquisition and analysis is a major advantage
- Programming experience (e.g., Python, MATLAB, Presentation) is a plus

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: October 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered in parallel to the project.

Name and Address of the Supervisor: PD Dr. Susanne Weis, Forschungszentrum Jülich, Institute for Neuroscience and Medicine (INM-7), 52425 Jülich, Germany; s.weis@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH www.fz-juelich.de

Department/Institute: Central Institute of Engineering, Electronics and Analytics- Engineering and Technology (ZEA-1), http://www.fz-juelich.de/zea/zea-1/EN/Home/home_node.html

Supervising scientist: Prof. Dr. G. Natour, Dr. S. M. Groß-Barsnick

University for Registration: RWTH Aachen University

Research Field: Materials Science, Energy Research

Position: PhD Student ☑ Sandwich PhD Student □

Research Area:

Growing demand for electrical energy together with limited resources and the necessity to reduce CO₂ emissions lead to an increased interest in alternative energy production. Solid oxide fuel cells (SOFC) are energy conversion devices for an efficient and clean production of electricity. Forschungszentrum Jülich is devoted to the topic for more than 20 years. The ceramic and metallic aggregates in a solid oxide fuel cell stack need to be sealed gas-tight and electrically insulating by a glass-ceramic sealant. At the time being, the sealant is crystallizing too slowly in terms of an industrialization of SOFC stack assembling.

Latest investigations of ZEA-1 have shown the temperature and time dependencies of the state-of-the-art sealing material. The current project concentrates on the controlled acceleration of the crystallization process by adding specific nuclei to the joining material. The preparation of glass and glass-ceramic samples and the evaluation of microstructures after thermal treatment by optical and electron microscopy together with the materials characterization of the novel composite materials are the topics of the PhD thesis. In further experiments, the applicability of improved materials should be investigated in stack tests under relevant conditions.

Beside of the experimental studies, the documentation and the presentation of the work (e.g. contribution to international conferences) is expected.

Specific Requirements:

A university degree (MSc) in one of the following subjects: mechanical engineering, materials science, chemistry, physics, mineral science. Soft skills like curiosity, creativity and team working ability are required.

Duration of stay: 48 months

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good knowledge of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. G. Natour, Forschungszentrum Jülich, Central Institute of Engineering (ZEA-1), 52425 Jülich, Germany, g.natour@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Energy and Climate Research, Electrochemical Process Engineering (IEK-3)
http://www.fz-juelich.de/iek/iek-3/EN/Home/home_node.html

Supervising scientist: Dr. Thomas Grube

University for Registration: RWTH-Aachen University

Research Field: Transportation technologies

Position: PhD Student ✔ Sandwich PhD Student □

Research Area:

Key questions regarding societal and environmental impact of future passenger transportation systems focus on the mix of powertrains and transport modes that cannot easily be projected from today’s perspective, mainly for two reasons. At first, locally emissions-free battery-electric (BEVs) and fuel cell (FCVs) cars are at the brink of mass market introduction, which may have a significant impact on future infrastructural requirements. Secondly, trends towards autonomous driving, car sharing and inter-modal transport are expected to have a major impact on mobility patterns. The objective of the planned research project is to develop and evaluate scenarios that integrate societal and technological trends in transportation regarding traffic volumes by transport mode, fuel demand by fuel type as well as user cost and environmental impact. The work should consider country-specific (Germany and China) and region-specific (by settlement type) constraints. A simulation model approach is suggested that allows for flexible and comprehensive analyses of the transportation sector based on defined time-steps until 2050.

Specific Requirements:

- Mechanical engineering / industrial engineering
- Knowledge in transportation systems, vehicle propulsion, and costing
- English

Duration of stay: 4 years

Work Place: Research Center Juelich, Germany

Earliest Start: September, 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. Detlef Stolten, Forschungszentrum Jülich, Institute of Energy and Climate Research (IEK-3), 52425 Jülich, Germany; d.stolten@fz-juelich.de; th.grube@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute of Bio- and Geosciences, Agrosphere (IBG-3)
Supervising scientist: Prof. Dr. Harrie-Jan Hendricks-Franssen
University for Registration: RWTH Aachen University
Research Field: Hydrology (Land surface and subsurface modelling)
Position: PhD Student 
Research Area:

Climate change and other human-induced actions modify the terrestrial water and energy cycles. It is therefore important that simulation models can adequately predict the impact of climate change and other human actions on the water and energy cycles. The model TerrSysMP is able to simulate the coupled water and energy cycles from the groundwater to the upper atmosphere, coupling a subsurface model, land surface model and atmospheric circulation model. One of the main advantages of this model is that it includes groundwater and the lateral movement of water in the subsurface. A TerrSysMP-model for Europe (the EURO-CORDEX domain) has been developed. Terrestrial model predictions of the coupled water and energy cycles are affected by errors related to uncertain model forcings, model parameters, model structural errors, initial conditions and boundary conditions. Sequential data assimilation, for example the assimilation of soil moisture information from remote sensing, allows improving terrestrial model predictions or reanalyses. Also a data assimilation framework has been coupled to TerrSysMP (TerrSysMP-PDAF) and is able now to assimilate groundwater level data, soil moisture data and discharge data, which has been tested at the catchment scale.

In this PhD-research, it is planned to assimilate remotely sensed soil moisture data measured by the SMAP-satellite in a multi-scale data assimilation approach. Use will be made of an already existing TerrSysMP model for the European CORDEX-domain. In a first step, an ensemble needs to be developed that covers the uncertainty of soil and vegetation parameters, as well as model forcings, across Europe. In a next step, data assimilation will be performed and it will be evaluated how the assimilation of soil moisture data from SMAP affects the simulation of other hydrological fluxes like evapotranspiration and discharge, and the simulation of hydrological states like groundwater levels. Finally, the assimilation will be extended to include other data types like groundwater levels. It is expected that the assimilation of further data types will further improve the modelling of the coupled water and energy cycles over the EURO-CORDEX domain. A successful PhD-thesis will be defended at RWTH Aachen.

Specific Requirements:

- MSc degree in for example hydrology, meteorology or soil science
- Experience with data assimilation is of advantage
- Good background in statistics
- Good programming skills
- Experience with remote sensing data is of advantage

Duration of stay: 48 months
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor: Prof. Dr. Harrie-Jan Hendricks-Franssen, Forschungszentrum Jülich, Institute of Bio- and Geoscience (IBG-3), 52425 Jülich, Germany; h.hendricks-franssen@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de


Supervising scientist: Prof. Dr. Harrie-Jan Hendricks-Franssen

University for Registration: RWTH Aachen

Research Field: Hydrology (Land surface and subsurface modelling)

Position: PhD Student X Sandwich PhD Student □

Research Area:

Land surface models are an important component of atmospheric circulation models as they calculate the exchange of water, energy, carbon and nitrogen between the land and the atmosphere. New generations of land surface models can increasingly realistic simulate this exchange. Nevertheless, land surface models still show large mutual differences in simulating evapotranspiration and photosynthesis under conditions of drought stress. It is only partly understood to what degree these differences are related to parameterizations or model formulations. It is however important to gain increased insight in these differences for improving model parameterizations and/or model formulations.

In this PhD-work it is planned to compare stand-alone CLM4.5 model simulations with soil moisture and eddy covariance (evapotranspiration and CO2-flux) measurements at drought prone locations, for example in the Mediterranean area, Australia and China. It will be investigated whether ensemble model simulations, which take into account all sources of uncertainty, are able to cover the measured values. A related research question is whether it is possible to fit parameter values which reproduce soil moisture and measured fluxes under all conditions closely. If ensemble calculations are often not able to cover the measurement data, and fitting parameters cannot resolve this issue, new parameterizations of the soil moisture-evapotranspiration relationships will be explored.

Specific Requirements:

- MSc degree in for example hydrology, ecology, meteorology or soil science
- Good background in statistics and data analysis
- Experience with simulation models
- Good programming skills are of advantage
- Experience with data assimilation is of advantage

Duration of stay: 48 months

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. Harrie-Jan Hendricks-Franssen, Forschungszentrum Jülich, Institute of Bio- and Geoscience (IBG-3), 52425 Jülich, Germany; h.hendricks-franssen@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute for Advanced Simulation/Jülich Supercomputing Centre
Supervising scientist: Dr. rer. nat. habil. Andreas Kleefeld
University for Registration: Brandenburg University of Technology Cottbus-Senftenberg
Research Field: Applied Mathematics
Position: PhD Student X Sandwich PhD Student □
Research Area:

Advanced image processing techniques for fields of symmetric matrices
A standard gray-valued image is either considered as a real-valued function \( f(x,y) \) of two
variables or as a large matrix with real-valued entries referred to as pixels. One of the most
basic operations in the nowadays almost ubiquitous field of mathematical image
processing is to perform a threshold operation to extract (sub/super-)level sets. This means
to select only those pixels respectively those values of variables such that the value \( f(x,y) \)
satisfies \( f(x,y) < c_1 \) or \( f(x,y) \leq c_2 \), with suitable constants \( c_1, c_2 \). A far more
sophisticated way of processing images is to use an image as initial condition in a time-
dependent partial differential equation (PDE); the time-evolved data then represent new
processed images. Depending on the PDE used, certain features of the initial image are
enhanced (i.e. edges), suppressed (i.e. noise), or extracted (i.e. shapes of objects). Yet
another approach is based on the use of integral operators: 2D-Fourier transform in its
continuous or discrete form are applied to identify repetitive features in texture-like
images.

All these techniques are well-established in the processing of gray-valued images.
However, in medical imaging (i.e. in diffusion tensor magnetic resonance imaging) or civil
engineering (i.e. elasticity in mechanics) a much more complex image type is of interest:
the values of the function \( f \) or the entries of the large matrix mentioned above are no
longer real numbers, but matrices themselves. To be precise, they are real symmetric 3x3-
matrices. These type of data is referred to as matrix field, or, more often, as tensor field.
It will be the task to transfer as much of the above mentioned techniques based on level
sets, PDEs or integrals to the setting of matrix fields as possible. Although the foundation
for this task has been prepared in various articles (by B. Burgeth & A. Kleefeld)
developing an operator-algebraic calculus for matrix fields, including Loewner order for
symmetric matrices and matrix-valued differential operators, the proposed methods are
awaiting improvements and extensions both numerically and theoretically.

Specific Requirements:

Very good knowledge in Mathematics: numerical solutions for partial differential equations,
numerical lineal algebra, and optimization.
Basic knowledge in image processing and numerical analysis.
Very good knowledge in programming: C or C++, Matlab or Octave.
Basic knowledge in high performance computing (MPI, openMP, CUDA).

Duration of stay: 48 months
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German
language course will be offered parallel to the project.
Name and Address of the Supervisor: Dr. Andreas Kleefeld, Forschungszentrum Jülich, Institute
for Advanced Simulation, Jülich Supercomputing Centre, 52425 Jülich,
Germany, a.kleefeld@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

<table>
<thead>
<tr>
<th><strong>Helmholtz Centre:</strong></th>
<th>Forschungszentrum Jülich GmbH – <a href="http://www.fz-juelich.de">www.fz-juelich.de</a></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Department/Institute:</strong></td>
<td>Institute of Bio and Geoscience, Agrospere (IBG-3) <a href="http://www.fz-juelich.de/ibg/ibg-3/EN/Home/home_node.html">http://www.fz-juelich.de/ibg/ibg-3/EN/Home/home_node.html</a></td>
</tr>
<tr>
<td><strong>Supervising scientists:</strong></td>
<td>Prof. Dr. Erwin Klumpp &amp; Prof. Dr. Roland Bol</td>
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<tr>
<td><strong>University for Registration:</strong></td>
<td>RWTH Aachen University and Amsterdam University (The Netherlands)</td>
</tr>
<tr>
<td><strong>Research Field:</strong></td>
<td>Terrestrial Biogeochemistry</td>
</tr>
<tr>
<td><strong>Position:</strong></td>
<td>PhD Student X Sandwich PhD Student □</td>
</tr>
<tr>
<td><strong>Research Area:</strong></td>
<td>Compare dust inputs of the Atacama desert (a hyper arid depositional desert) with other more erosional deserts in China and other locations in the world. Significant key inputs to soil surfaces are likely to enter via atmospheric (dust) deposition in deserts. Hence it is pertinent that for the overall understanding and evolution of these unique dryland terrestrial systems we examine and better understand the dynamic dust inputs to the desert soil and where the dust comes from, what drives its translocations, what nutrient and carbon dust contains and how it varies over space and time. The study will use multiple source elucidation techniques (isotopes, nutrient stoichiometry, colloidal profiling etc.).</td>
</tr>
</tbody>
</table>

**Specific Requirements:**

A Ph.D. student who is currently working in a University with a specific focus on agriculture, environmental science or arid/dryland ecosystems. An additional background in chemistry, biogeochemistry or, soil science or agriculture is beneficial. Experience in with (stable) isotope analyses, mass spectrometry, field flow fractionation (FFF) or dust sampling techniques, together with data analysis skills is beneficial. Experience in designing experiments is a plus. Good knowledge of the English language also. Experience with field work in arid/drylands or other extreme environment is helpful.

<table>
<thead>
<tr>
<th><strong>Duration of stay:</strong></th>
<th>4 years</th>
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<tbody>
<tr>
<td><strong>Work Place:</strong></td>
<td>Forschungszentrum Juelich, Germany (near Cologne)</td>
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<tr>
<td><strong>Earliest Start:</strong></td>
<td>September 2018</td>
</tr>
<tr>
<td><strong>Language Requirement:</strong></td>
<td>Very good knowledge of English, written and spoken. A German language course will be offered parallel to the project</td>
</tr>
<tr>
<td><strong>Name &amp; Address of Supervisor:</strong></td>
<td>Prof. Dr. Erwin Klumpp, Institute for Bio- and Geosciences (IBG-3), Forschungszentrum Juelich, 52425 Juelich, Germany <a href="mailto:e.klumpp@fz-juelich.de">e.klumpp@fz-juelich.de</a></td>
</tr>
</tbody>
</table>
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute of Energy and Climate Research, Nuclear Waste Management and Reactor Safety (IEK-6);
Research Project: Large scale simulations of solids phases important for nuclear waste management
Supervising scientist: Dr. Piotr Kowalski
University for Registration: RWTH Aachen University
Research Field: Atomistic modeling, Nuclear Waste Management, High Performance Computing
Position: PhD Student ☑️ Sandwich PhD Student ☐
Research Area:

In Institute of Energy and Climate Research: Nuclear Waste Management and Reactor Safety (IEK-6) we investigate solid state chemistry and physics of materials that could: be suitable for disposal of nuclear waste or form as secondary phases during waste/spent fuel disposal. The project consists of advance atomistic modeling of actinide-bearing materials in order to characterize their physical and chemical properties that are determined by presence of actinide and other radionuclide cations, including T & P driven phase transition and electronic properties. The studies will aim into computational characterization of newly synthesized actinide-bearing solid phases by application of reliable, quantum chemistry-based computational techniques suitable for simulation of f-elements-bearing materials and will be performed using large supercomputing resources available at Forschungszentrum Jülich (Research Centre Jülich). The research will complement the experimental effort on solid state chemistry of actinides and nuclear waste ongoing in our institute and will require active interaction with various internal and external experimental and modeling groups.

Research area:
  - atomistic modeling of materials: ab initio & force fields simulation techniques using state-of-the-art methods of modern quantum chemistry and materials science.
  - Solid state chemistry of actinides and nuclear waste management: atomistic modeling of actinide-bearing solid phases.

Specific Requirements: For PhD student: Master degree in physics, chemistry, computational, geo- or material science. Experience in: working under Linux environment, atomistic simulations and high performance computing would be appreciated but not essential.

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor: Dr. Piotr Kowalski, Forschungszentrum Jülich, Institute of Energy and Climate Research (IEK-6), 52425 Jülich, Germany; p.kowalski@fz-juelich.de;
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute of Energy and Climate Research, Materials Synthesis and Processing (IEK-1), http://www.fz-juelich.de/iekk1/EN/Home/home_node.html,
Supervising scientists: Prof. Dr. M. Krüger, Dr. G. Hasemann
University for Registration: RWTH Aachen
Research Field: Materials Science
Position: PhD Student X
Research Area:
High-Entropy Alloys (HEAs) are a new class of materials which gained enormous scientific interest during the last 10 to 15 years. Traditionally, conventional alloying concepts are focused on one or two base elements, i.e. such as Fe-, Cu-, Ni-, Co-, Ti or Al based alloys. The concept of HEAs differs dramatically by increasing the number of base elements as well as their concentrations. Compared to traditional alloys, HEAs aren’t composed of a single principle element or minor alloy additions to form the desired microstructure and properties and thus, become chemically very complex. By increasing the number of base elements, the HEA strategy aims to maximize the configurational part of the entropy which stabilizes the disordered, single-phase solid solution consisting of simple crystal structures such as fcc, bcc or hcp. For scientific purposes one may differ between HEAs as a more academic definition aiming at multicomponent alloys of at least 5 equimolar elements to form a simple structured single-phase material. However, the related concept of compositionally complex alloys (CCAs) might be understood in an engineering-type approach that may differ from equimolarity and consist of more than one phase, e.g. of a solid solution matrix with simple-crystal structure which is particle strengthened by second phase precipitation, a concept which is comparable with superalloys. A completely new variety of alloy systems with adjustable microstructures and unique properties seems to be possible by following those new multicomponent alloy strategies.
The proposed PhD project should focus on the alloys design of new HEAs or CCAs and their distinct microstructure-property-relationship. This involves the processing, heat treatment and testing of, e.g. mechanical properties (hardness and yield stress as a function of temperature) or chemical properties (high temperature oxidation under different environmental conditions) of these materials. The work is embedded into a quickly growing research community which is based on a completely new type of materials.

Specific Requirements:
A university degree (BEng., BSc., MSc) in one of the subject mechanical engineering, materials science or applied physics as well as creativity, scientific interest and team working ability are required.

Duration of stay: 48 months
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good knowledge of English, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor: Prof. Dr. M. Krüger, Forschungszentrum Jülich GmbH, IEK-2, 52425 Jülich, Germany; m.krueger@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Central Institute for Engineering, Electronics and Analytics, Analytics (ZEA-3)
University of Duisburg-Essen, Faculty of Chemistry, www.uni-due.de/iac/
University Duisburg-Essen, Faculty for Engineering Science, www.uni-due.de/Wassertechnik/

Supervising scientist: Dr. Holger Lutze (Essen), Dr. Stephan Küppers (Jülich) and
Prof. Stefan Panglisch (Essen)

University for Registration: Universität Duisburg-Essen
Research Field: Water treatment
Position: PhD Student X Sandwich PhD Student □

Research Area:
The aim of the project is to develop advanced strategies for minimization of by-product formation in oxidation processes. Thereby the coupling of different chemical processes and physical processes will be investigated. The work will focus on by-products formed during drinking and wastewater ozonation. Bromate, an oxidation product of bromide is one major drawback in ozonation since it has a very low drinking water standard (WHO: 10 μg/L). Most applied strategies for minimizing bromate formation are based on the addition of other chemicals such as hydrogen peroxide or ammonia, which can also cause undesired side effects. The new approach focuses on separating bromide from the ozonation process using nanofiltration (NF). Special (low dense) NF materials can remove pollutants but are permeable for bromide. The pollutants in the brine can readily be treated by ozone, because bromide levels are mitigated. The candidate will be involved in oxidation experiments, process development and analytics.

Specific Requirements:
- Master degree or an analogous certificate in natural science or engineering related to water treatment
- Good language skills (English)
- Good software skills (word, excel, PowerPoint, ChemDraw)
- Capacity for teamwork
- Multidisciplinary thinking

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich (near Cologne) and University Duisburg-Essen, Germany
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.
Name and Address of the Supervisor: Dr. Stephan Küppers, Forschungszentrum Jülich GmbH, Central Institute for Engineering (ZEA-3), 52425 Jülich, Germany s.kueppers@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich – www.fz-juelich.de

Department/Institute: Institute of Complex Systems, Structural Biochemistry (ICS-6)
https://www.cssb-hamburg.de/research/joerg_labahn/index_eng.html

Supervising scientist: Prof. Dr. Jörg Labahn

University for Registration: Heinrich-Heine-Universität Düsseldorf

Research Field: Structural Biology

Position: PhD Student X
Sandwich PhD Student □

Research Area:

Molecular pathology of disease relevant human proteins. Biochemical, spectroscopic and structural analysis of protein states relevant for function and dysfunction.

Prostate apoptosis response 4 protein (Par-4) is a pro-apoptotic protein with tumor suppressor activity. Par-4 has been linked to various pathologies like several cancers, neurodegenerative diseases, HIV encephalitis, Mycobacterium tuberculosis, etc. Par-4 is a predominantly disordered multi-domain protein. The important feature of Par-4 is that its ectopic expression induces apoptosis selectively in certain cancer cells but not in normal or immortalized cells, where it sensitizes them to various apoptotic stimuli.

This project is aimed at understanding the functional mechanism of Par-4. Development of a research program based on the interests and skill profile of the applicant is possible and encouraged.

Specific Requirements:

- Masters in biology, biochemistry or related field. Knowledge of basic laboratory work e.g. cloning, PAGE, western-blot, interest in biophysical approaches. Interest in structural methods would be of advantage.
- The laboratory language is English. We have Chinese speaking group members, but proper knowledge (IELTS qualified) of English is a must, learning German on campus is encouraged.
- Enrolment at Heinrich-Heine-Universität Düsseldorf as a PhD candidate is required: http://www.math-nat-fak.hhu.de/en/doctoral-research.html

Duration of stay: 4 years

Work Place: Center for Structural Systems biology, Hamburg - https://www.cssb-hamburg.de/

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of Supervisor: Prof. Dr. J. Labahn, CSSB, Notkestraße 84, 22607 Hamburg, Germany, j.labahn@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich – www.fz-juelich.de

Department/Institute: Institute of Complex Systems, Structural Biochemistry (ICS-6)
https://www.cssb-hamburg.de/research/joerg_labahn/index_eng.html

Supervising scientist: Prof. Dr. Jörg Labahn

University for Registration: Heinrich-Heine-Universität Düsseldorf

Research Field: Structural Biology

Position: PhD Student X

Research Area:

Molecular pathology of disease relevant human proteins:
Biochemical, spectroscopic and structural analysis of protein states relevant for function and dysfunction. Interdisciplinary (membrane) protein science.

This project is aimed at understanding the functional mechanism of specific host protein interaction with pathogens in infection. Expression, purification, crystallization and functional characterization of human proteins are essential steps. Structural states are to be characterized by CD and fluorescence spectroscopy, and structural methods e.g. X-ray crystallography.

Development of a research program based on the interests and skill profile of the applicant is possible and encouraged.

Specific Requirements:

Masters in biology, biochemistry or related field. Knowledge of basic laboratory work e.g. cloning, PAGE, western-blot, interest in biophysical approaches. Interest in structural methods would be of advantage.

The laboratory language is English. We have Chinese speaking group members, but proper knowledge (IELTS qualified) of English is a must; learning German on campus is encouraged.

Enrolment at Heinrich-Heine-Universität Düsseldorf as a PhD candidate is required:

Duration of stay: 4 years

Work Place: Center for Structural Systems Biology, Hamburg - https://www.cssb-hamburg.de/

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of Supervisor: Prof. Dr. J. Labahn, CSSB, Notkestraße 85, 22607 Hamburg, Germany, j.labahn@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Energy and Climate Research, Electrochemical Process Engineering (IEK-3)
http://www.fz-juelich.de/iek/iek-3/EN/Home/home_node.html

Supervising scientist: Prof. Dr. W. Lehnert

University for Registration: RWTH Aachen University

Research Field: Fuel cell and electrolyser modelling and simulation

Position: PhD Student ☒ Sandwich PhD Student ☐

Research Area: Polymer electrolyte fuel cells and polymer electrolyte electrolysers are currently under development with a focus on high efficiency and lifetime. The development of these electrochemical energy converters is supported by modeling and simulation. One major challenge is the mathematical description of the simultaneous transport of water and gas in the cells. These two-phase flow phenomena take place inside the flow channels as well as inside the stochastic porous components of the Membrane Electrode Assembly. The flow channels have dimensions in the mm range, whereas the pore sizes of the porous media under examination are in the micrometer range.

The research topic addresses investigations on fluid transport in the porous media. The proposed work includes:
- Simulating mass transport in the voids of the microstructure with the Lattice Boltzmann method
- Modifying the simulation code in order to implement new models
- Determination of the geometric and physical characteristics of the microstructure

The effects shall be evaluated according to the foreseen application in the fuel cell area. The detailed understanding of transport processes in fuel cells belongs to the major challenges of cutting-edge research in energy engineering.

Specific Requirements:
- Foundations in gas kinetics; excellent grades in Mathematics; excellent programming skills; excellent knowledge in process engineering; very good understanding in anorganic chemistry; ability to work in a team / excellent team player

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. Werner Lehnert, Forschungszentrum Jülich, Institute of Energy and Climate Research (IEK-3), 52425 Juelich, Germany; w.lehnert@fz-juelich.de, http://www.fz-juelich.de/iek/iek-3/EN/ueberuns/ansprechpartner/heads%20of%20department/lehnert_person_2015.html?nn=5574

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Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Energy and Climate Research, Electrochemical Process Engineering (IEK-3)
http://www.fz-juelich.de/iek/iek-3/EN/Home/home_node.html

Supervising scientist: Prof. Dr. D. Stolten, Jochen Linssen

University for Registration: RWTH-Aachen University

Research Field: Electrical engineering

Position: PhD Student ✔ Sandwich PhD Student □

Research Area:
Electric drivetrains are the key elements for a low-carbon and energy-efficient transport which is based on renewable energy. Furthermore, a mobility with local zero emissions is an important step to improve the quality of life substantially. In particular, this is the case for metropolitan areas. Battery electric vehicles offer these important possibilities. However, the construction of a new charging infrastructure becomes necessary and the additional charging demand will stress the electric grid.

Objective of the planned research activity is a detailed design study for the charging infrastructure needs for battery electric vehicles with focus to distribution grid enhancement due to slow and fast charging. In the light of a case study, the analysis should conduct detailed grid calculations for typical distribution grid architectures for China and for Germany under consideration of different penetration levels of charging options. Based on that, a comparative techno economic analysis for the required grid extension measure for typical distribution grids will be performed.

Specific Requirements:

- Electrical engineering / industrial engineering
- Knowledge in electric grid, energy systems, and costing
- English

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September, 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. Detlef Stolten, Forschungszentrum Jülich, Institute of Energy and Climate Research (IEK-3), 52425 Jülich, Germany; d.stolten@fz-juelich.de; j.linssen@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – fz-juelich.de

Department/Institute: Institute for Energy and Climate Research, Microstructure and Properties of Materials (IEK-2) and Excellent Materials for the Future (IEK-1)
http://www.fz-juelich.de/iek/iek-2/EN/Home/home_node.html
http://www.fz-juelich.de/iek/iek-1/EN/Home/home_node.html

Supervising scientist: Prof. Dr. M. Krüger, Dr. J. Malzbender, Dr. J. Gonzalez

University for Registration: RWTH Aachen

Research Field: Materials Science

Position: PhD Student X

Research Area:
Mechanical properties of MAX phase materials. The high global energy consumption and its expected increase over the next few decades are the main challenges for power generation in a global context. Regarding the energy consumption, more efficient and environmentally-friendly processes are clearly required, which can be achieved by increasing the operating temperature of power generation systems. Power generation systems, such as gas turbines, consume fuel to produce power and heat. The lack of a single structural material fulfilling these requirements has led to the necessity of coating the hottest components in gas turbines with thermal barrier coatings. Nickel-based superalloys are currently used in the hottest parts of gas turbines due to their unique combination of properties, although their maximum operating temperature is limited to 1150 °C. MAX phases or ultra-high temperature ceramics are the only real alternative for increasing the service temperature beyond the limits. In addition, the advantages of MAX phases over other structural ceramics are: better fracture toughness and damage tolerance and machinability by milling and turning or electrical discharge machining. Current challenges include the application relevant mechanical limits, requiring careful assessment of materials properties on micro- and macroscopic level. This can be realized via advanced destructive and non-destructive characterization techniques in combination with optical and electron microscopy based microstructural characterization. Along with clarification and consideration of degradation mechanisms, those properties are to be used in lifetime prediction models. Such characterizations for ceramic materials are the aim of the proposed PhD work, where especially the relationships between properties and microstructure are to be analyzed on the basis of supporting light-, scanning electron and tunneling electron microscopic investigations. The scientific work is focused on an extremely important subject with relevance for industrial application in a strongly interdisciplinary environment with the opportunity to use up-to-date processing and characterization technologies.

Specific Requirements:

A university degree (BEng, BSc., MSc) in one of the subject mechanical engineering, materials science, mineral science, or applied physics as well as creativity, scientific interest and team working ability are required.

Duration of stay: 48 months
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. M. Krüger, Forschungszentrum Jülich GmbH, Institute for Energy and Climate Research (IEK-2), 52425 Jülich, Germany; m.krueger@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute for Energy and Climate Research, Microstructure and Properties of Materials (IEK-2) and Excellent Materials for the Future (IEK-1)
http://www.fz-juelich.de/iek/iek-2/EN/Home/home_node.html
http://www.fz-juelich.de/iek/iek-1/EN/Home/home_node.html

Supervising scientist: Prof. Dr. W.A. Meulenberg, Prof. Dr. M. Krüger, Dr. J. Malzbender, Dr. M. Ivanova

University for Registration: University of Twente, Enschede, Netherlands
Research Field: Materials Science

Position: PhD Student X Sandwich PhD Student □

Research Area:
Processing and mechanical properties of proton conduction membrane materials
Climate related aspects and limited environmental resources receive increasing consideration in energy technologies, significantly motivating the development of new materials and their research on both fundamental and applied level. The definition of suitable candidates for membrane applications addresses a number of issues as its performance, thermo-chemical/mechanical and phase stability, compatibility with other components, etc. and needs to realize an appreciable compromise between various material properties under relevant operating conditions. An important aspect of this scientific field and hence of the work at the Institute for Energy and Climate Research is the development and characterization of proton conducting materials and membranes for the use in advanced energy systems (membrane modules for H₂ separation or membrane reactors for chemical synthesis, e.g. utilizing CO₂), where development of graded membrane architectures is based on modern, reproducible and cost efficient methods like freeze and tape casting and characterization covers the range from functional properties to mechanical limits under operation relevant conditions. The current project concentrates on dual phase materials that combine two ceramic phases advantageously offering electronic and ionic (protonic) conductivity, respectively. In addition to an optimization of manufacturing porous supports and deposition of dense membrane layers with optimized performance and chemical stability, current challenges include the application relevant mechanical limits, requiring careful assessment of materials properties on micro- and macroscopic level. This can be realized via advanced destructive and non-destructive characterization techniques in combination with optical and electron microscopy based microstructural characterization. Along with clarification and consideration of degradation mechanisms, those properties are to be used in lifetime failure models. The characterizations are the aim of the proposed PhD work, where especially the relationships between properties and microstructure are to be analyzed on the basis of supporting light-, scanning electron and tunneling electron microscope investigations. The scientific work is focused on an extremely important subject with relevance for industrial application in a strongly interdisciplinary environment with the opportunity to use up-to-date processing and characterization technologies.

Specific Requirements:
A university degree (BEng., BSc., MSc) in one of the subject mechanical engineering, materials science, mineral science, or applied physics as well as creativity, scientific interest and team working ability are required.

Duration of stay: 48 months
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. W. A. Meulenberg, Forschungszentrum Jülich GmbH, Institute for Energy and Climate Research (IEK-1), 52425 Jülich, Germany w.a.meulenberg@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Central Institute for Engineering, Electronics and Analytics, Engineering and Technology (ZEA-1), http://www.fz-juelich.de/zea/zea-1/EN/Home/home_node.html

Supervising scientist: Prof. Dr. M. Krüger, Dr. J. Malzbender, Dr. S. M. Groß-Barsnick

University for Registration: RWTH Aachen

Research Field: Materials Science

Position: PhD Student ☑ Sandwich PhD Student ☐

Research Area:

Mechanical behavior of solid oxide fuel cell materials Climate related aspects and limited environmental resources receive increasing consideration in the evolution of energy technologies. Hence, the development of new materials receives increasing attention in basic and applied research. An important aspect of this scientific field and hence of the work at the Jülich is the improvement and characterization solid oxide fuel cell materials for the use in advanced energy systems, where characterization covers the range from functional properties to mechanical limits under operation relevant conditions. The current project concentrates on the mechanical reliability limits of ceramic materials as well as metallic materials envisaged for the use in solid oxide fuel cell stacks. Work focuses on application relevant elastic, plastic and fracture behavior that will be assessed with a novel elevated temperature indentation testing system that permits micromechanical tests up to an operation relevant temperature of 900°C. Within the framework of the study standard as well as innovative materials are to be characterized, concentrating on the as-produced and properties after operation relevant aging, were in particular the interrelationship of microstructure and local as well as global properties has to receive particular attention. This can be realized via the advanced micromechanical characterization technique in combination with optical and electron microscopy based microstructural characterizations. Along with clarification and consideration of degradation mechanisms, those properties are to be used in lifetime prediction models. The characterizations for these ceramic composite materials are the aim of the proposed PhD work, where especially the relationships between properties and microstructure are to be analyzed on the basis of supporting light-, scanning electron and tunneling electron microscopic investigations. The scientific work is focused on an extremely important subject with relevance for industrial application in a strongly interdisciplinary environment with opportunity to use up-to-date processing and characterization technologies.

Specific Requirements:

A university degree (BEng., BSc., MSc) in one of the subject mechanical engineering, materials science, mineral science, or applied physics as well as creativity, scientific interest and team working ability are required.

Duration of stay: 48 months

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project, additionally.

Name and Address of the Supervisor: Prof. Dr. M. Krüger, Forschungszentrum Jülich GmbH, Institute for Energy and Climate Research (IEK-2), 52425 Jülich, Germany; m.krueger@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute for Energy and Climate Research, Microstructure and Properties of Materials (IEK-2)
http://www.fz-juelich.de/iek/iek-2/EN/Home/home_node.html

Supervising scientist: Prof. Dr. M. Krüger, Dr. J. Malzbender

University for Registration: RWTH Aachen

Research Field: Materials Science

Position: PhD Student X  Sandwich PhD Student □

Research Area:

Lifetime of laser drilled thermal barrier components. Awareness to climate related aspects and limited environmental resources receive increasing consideration in the progress of energy technologies. An important aspect of this scientific field and hence of the work at the Institute for Energy and Climate Research is the characterization of thermal barrier coatings for the use in advanced energy systems. The use of thermal barrier coatings is essential in stationary and mobile turbine components, where advanced concepts rely upon drilled components, where air cooling is applied to reduce the surface temperature of the thermal barrier ceramics layer. The current work concentrates on the effect of such holes drilled by different technologies onto the lifetime of thermal barrier composites in different loading situations, i.e. thermal cycling, low cycle and thermomechanical fatigue. Assessment of the lifetime requires careful assessment of materials failure initiation and progress on micro- and macroscopic level, via a combination of advanced testing and non-destructive as well as post-operational characterization techniques in combination with advanced optical and electron microscopy based microstructural characterization techniques. Along with considerations of degradation effects, aim is the derivation of lifetime prediction models. Hence characterization and data based modelling are the aim of the PhD work, where especially the relationships between long term behavior under different loading condition and microstructure are to be analyzed on the basis of supporting light-, scanning electron and tunneling electron microscopic investigations. The scientific work is focused on an extremely important subject with application importance in a strong interdisciplinary environment with the possibility to use up-to-date characterization technologies and access to modern light and electron microscopic methods.

Specific Requirements:

A university degree (BEng., BSc., MSc) in one of the subject mechanical engineering, materials science, mineral science or applied physics and creativity, scientific interest and team working ability

Duration of stay: 48 months

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. M. Krüger, Forschungszentrum Jülich GmbH, IEK-2, 52425 Jülich, Germany; m.krueger@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH - www.fz-juelich.de

Department/Institute: Institute of Energy and Climate Research, Microstructure and Properties of Materials (IEK-2)
http://www.fz-juelich.de/iek/iek-2/EN/Home/home_node.html

Supervising scientist: PD Dr. Michael Müller

University for Registration: RWTH Aachen University

Research Field: Energy conversion and storage; High temperature chemistry

Position: PhD Student ☒ Sandwich PhD Student ☐

Research Area:

By using thermal energy storage (TES) in industry and power production, load changes and fluctuating renewable energy supply can be compensated and the overall efficiency can be increased. Currently, mainly the sensible heat of salt systems, e.g. alkali nitrates, is used for TES because of low price and suitable temperature range. However, latent TES with phase change materials (PCM) would be more effective, since more energy can be stored in a very narrow temperature range. For the selection of suitable systems, it is of considerable importance to know their thermodynamic properties and phase diagrams. Moreover, PCMs need a melting temperature adjusted to a specific application. Since the availability of suitable congruent melting salts is limited, eutectic salt mixtures are of interest. However, there is a lack of data of those systems. Therefore, the properties of relevant salt mixtures will be studied by different, complementary methods of physicochemical analysis, e.g. DTA, DSC, KEMS, XRD etc., in order to provide a sufficiently reliable database and based on these experimental data a consistent dataset for the systems will be built using the CALPHAD method. Using this dataset, suitable mixtures for specific applications will be identified without trial-and-error method.

Specific Requirements:

Master degree in the field of chemistry, physics, materials science, or engineering; strong interest in both, experimental investigations and modelling; social competence and good communication skills for collaborative work in and with interdisciplinary teams

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good knowledge of English language, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Priv.-Doz. Dr. Michael Müller, Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research (IEK-2), 52425 Jülich, Germany, email: mic.mueller@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de


Supervising scientist: Prof. Dr. Andreas Offenhäusser, Dr. Dirk Mayer

University for Registration: University of Aachen (RWTH)

Research Field: Biomedical research / Biomaterials / Bioelectronics

Position: PhD Student X

Research Area: Influence of neuron development by nanoparticles.

Nanomaterials have been widely used as powerful platform to influence cell fate and development. For biomedical applications, nanomaterials are commonly utilized for drug delivery, photothermal therapy, biosensing, and bioimaging. In particular, gold nanoparticle possess great potential in biomedical research due to their chemical inertness and the fact that their shape and size can be easily controlled. In the scope of this project we aim to bind gold nanoparticles of different shape and size to solid surfaces in order to enhance the performance of biomedical devices and improve the biocompatibility of bioelectronics implants. We expect that the particles will modulate the adhesion of neurons, their maturation as well as their electrophysiological properties. For this purpose, gold nanoparticles will be synthesized, bound to solid surfaces, and utilized to grow cells on them. Lithographical methods will be used to define patterns of particles for a local control of neuron adhesion and network formation. A systematic study on neuron development as function of particle size, density, and distribution will be conducted. We offer an up-to-date research topic in the field of biomedical research involving microfabrication of sample surfaces. The institute operates a clean room facility, has a strong expertise in cellular and molecular biology.

Specific Requirements:

The candidate should have been trained either in biochemistry, chemistry, material sciences, or biophysics. Interest in interdisciplinary research is requested for the successful development of the project. Instruction and guidance will be provided for all experimental techniques by the supervising team.

Duration of stay: 4 years

Work Place: Research Centre Juelich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good English skills; A German language course will be offered parallel to the project

Name and Address of the Supervisor: Forschungszentrum Jülich, Dr. Dirk Mayer, Institute of Complex Systems, Bioelectronic (ICS-8), 52425 Jülich, Germany / dirk.mayer@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de
Department/Institute: Institute of Complex Systems, Bioelectronics (ICS-8)
http://www.fz-juelich.de/ics/ics-8/EN/Home/_node.html
Supervising scientist: Prof. Dr. A. Offenhäusser and Dr. Y. Mourzina
University for Registration: RWTH Aachen University
Research Field: Key Technologies - Sensorics and bioinspired systems
Position: PhD Student □ Sandwich PhD Student □
Research Area:

The Institute of Complex Systems-8 (Bioelectronics) performs research on functional coupling of evolutionary optimized biological and biomimetic recognition systems with micro- and nanoelectronic transducers for the development of sensors and bioelectronics devices. In the focus are development and study of properties of electrochemical multisensor systems with oxidoreductase enzymes, molecular macrocycles, and their nanostructures based on molecular assembly for detection and monitoring of reactive oxygen species and redox signaling in single cells, cellular systems, and tissues. Electrochemical and catalytic properties of oxidoreductase enzymes and biomimetic metallloporphyrin compounds with electrocatalytic activities immobilized on the nanostructured electrodes will be studied in the research work aimed at the application of bioelectrocatalysis in the field of electrochemical (bio)sensors for the determination of reactive oxygen species. Main scientific problems to be solved is the organization of the effective electron transfer between electrocatalytic centre of an enzyme or compound and an electrode, which can be facilitated by nanomaterials. Chemically and electrochemically synthesized metal nanowires, nanoparticles, and carbon-based nanomaterials will be employed as nanoelectronic building blocks. Based on the results of the studies, novel mediatoreless sensors and multisensor systems for the electrochemical detection of reactive oxygen species with high spatio-temporal resolution should be developed. The sensors should be employed in the studies of the function of the reactive oxygen species in normal and pathological conditions in the cell lines, cultured primary cardiac muscle cells, neuronal, and stem cells.

At the institute, experience in nanotechnology, electrochemical methods, structural characterization, and cell culture is available.

Specific Requirements:

Master studies of Chemistry or equivalent. Good knowledge of English language. The successful thesis will be defended at RWTH Aachen University.

Duration of stay: 4 years
Work Place: Forschungszentrum Jülich, Germany (near Cologne)
Earliest Start: September 2018
Language Requirement: Very good knowledge of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. A. Offenhäusser, Dr. Y. Mourzina,
Forschungszentrum Jülich, Institute of Complex Systems (ICS-8), 52425 Jülich, Germany
a.offenhaeusser@fz-juelich.de, y.mourzina@fz-juelich.de
Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Institute of Complex Systems, Structural Biochemistry (ICS-6)
www.fz-juelich.de/ics/ics-6/DE/strodel

Supervising scientist: Prof. Dr. Birgit Strodel

University for Registration: Heinrich Heine University Düsseldorf

Research Field: Computational Chemistry

Position: PhD Student X Sandwich PhD Student □

Research Area:

In the Computational Biochemistry Group at the Jülich Research Centre we employ biomolecular simulation methods such as molecular dynamics (MD) aiming to understand the physicochemical principles that govern the highly complex process of protein aggregation. This process may lead to fatal diseases, as in the case of Alzheimer’s disease, but we can also profit from it in the form of novel nanomaterials. However, all-atom MD studies of protein aggregation suffer from the problem that the accuracy of current all-atom force fields in representing protein-protein interactions is insufficient, preventing the reproduction and consequently the interpretation of experimental results. In this project you will perform quantum chemical (DFT) calculations of peptide aggregates in order to understand the origin of the force field failures and work on improving the force fields. For more information please contact Prof. Strodel.

Specific Requirements:

1. Excellent knowledge in chemistry.
2. Experience with quantum chemistry.
3. Experience with Linux.
4. Programming experience (C++, Python or Perl) is beneficial.
5. Very good English skills (speaking and writing)

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Prof. Dr. Birgit Strodel, Forschungszentrum Jülich, Institute of Complex Systems (ICS-6), 52425 Juelich, Germany
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Helmholtz Call for 2018 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich – www.fz-juelich.de


Supervising scientist: Dr. Bei Wu

University for Registration: University of Bonn

Research Field: Iron cycle and stable iron isotopes in paddy ecosystems

Position: PhD Student X Sandwich PhD Student □

Research Area: Paddy ecosystems experience specific redox reactions and subsequent biogeochemical process, and are thus mainly characterized by unique dynamics in iron (Fe). This project is to test the hypothesis that Fe isotope signatures and Fe speciation of paddy soils may be scaled as a function of land-use duration. The PhD work is scheduled for 4 years to study a paddy soil chronosequence up to 2000 years with adjacent non-paddy soils, as well as rice, upland and dry season plants. We will provide archive paddy soil samples, but the newly flooded topsoils of the paddy fields are planned to be sampled as well. By analyzing Fe concentrations, isotope signatures, as well as Fe speciation, the study is to reconstruct Fe cycling rate in such ecosystems.

Specific Requirements:

Master’s degree in Chemistry, Soil Sciences, Agricultural Sciences, or Environmental Sciences. Good at inorganic and analytical chemistry and soil-plant analyses. Experiences with iron chemistry, analytical techniques such as (multi-collector-) inductively coupled plasma mass spectrometry (I(C)-ICP-MS), or speciation analyses using synchrotron-based facilities, familiar with paddy ecosystems are advantageous.

Duration of stay: 4 years

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2018

Language Requirement: Very good command of English, written and spoken. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Dr. Bei Wu, Institute of Bio- and Geosciences: Agrosphere (IBG-3), Forschungszentrum Jülich, 52428 Jülich, Germany, Email: b.wu@fz-juelich.de