

Call for Proposals

No. 63

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Priority Programme “Turbulent Superstructures” (SPP 1881)

The Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) has established the Priority Programme “Turbulent Superstructures” (SPP 1881), which is intended to run for another three years. The call invites submissions of proposals for the second three-year funding period starting in fall 2019.

The classical picture of turbulence is that turbulent fluid motion is characterised by a cascade of vortices and swirls of different sizes that give rise to a featureless and stochastic fluid motion. Our daily experience shows, however, that turbulent flows in nature and technology are often organised in prominent large-scale and long-living structures that can cause extreme fluctuations. The focus of the Priority Programme are “Turbulent Superstructures”, i.e., patterns whose coherence does not stop at the natural scale, such as the boundary layer height, but extends over much larger scales. When present, superstructures can dominate the global transport of mass, heat and momentum, act as barriers to transport, and increase the variability and fluctuations in the flow.

Currently very little is known about the origins, dynamics, and impact of superstructures on turbulent flow properties. Furthermore, their consequences for the statistical properties of turbulent flows, and their connection to the occurrence of extreme events are poorly understood. The study of superstructures is now possible due to significant advances in measurement techniques, numerical simulation, and mathematical characterisation. Tomographic laser-based measurement techniques can track the dynamics of turbulent structures with unprecedented resolution in space and time. Direct numerical simulations on massively parallel supercomputers have advanced to a level where turbulent flows in extended domains can be simulated at sufficiently high Reynolds numbers and in parameter ranges where superstructures emerge. Efficient methods to characterise dominant vortices and flow structures and to determine the transport across their boundaries as well as their dynamical evolution have been developed in applied mathematics. Computer science provides efficient algorithms for the visualisation of structures in very large data sets.

The aim of the Priority Programme is to integrate the different recent advances to arrive at a comprehensive characterisation and understanding of turbulent superstructures. Projects within the proposal should contribute to several of the following aspects:

- experimental characterisation of superstructures
- direct numerical simulations of turbulent large-scale and superstructures
- Lagrangian and Eulerian methods for detection and identification
- modelling the origin and dynamics of turbulent superstructures
- fast processing and visualisation of large data sets

In order to assist networking between applicants before the deadline for proposals, we ask new groups, who are considering applying within this call, to submit a description of the planned project (max. 1 page!) by **30 November 2018** to the scientific coordinator. The list of existing projects can be found at the programme webpage.

Proposals should contain ideas that help:

- to detect superstructures effectively and rapidly by the application of Eulerian and Lagrangian analysis tools
- to unravel the origin of superstructures from primary and secondary flow instabilities or from instabilities in fully developed turbulence
- to understand the mechanics of superstructures as well as the role of symmetries and boundary conditions
- to quantify the fluxes of mass, heat and momentum across the evolving interfaces, and the overall impact of superstructures on global transport and turbulence statistics
- to develop approaches for the control and the efficient modelling of turbulent superstructures in reduced models
- to develop reliable measures for short-term forecasts of extreme events in high Reynolds number turbulence

In order to keep the programme focussed, it is intended to study single-phase, wall-bounded flows in simple, typically Cartesian and parallel geometries, driven by shear or buoyancy. Other flows can only be considered if they can add to the understanding of superstructures in the above group of flows.

Each participant has to submit a separate proposal, which clearly indicates the planned collaboration with other applicants since an interdisciplinary research approach is essential for the success of this program.

Research proposals for the second three-year funding period, to be written in English, are now invited. Please include a title page with your name, institution, and the title of your project in your application. The deadline for proposal submission is **27 February 2019**.

Proposals must be submitted via elan, the DFG's electronic proposal processing system. Applicants must be registered in elan prior to submitting a proposal to the DFG. You will normally receive confirmation of your registration by the next working day. Note that you will be asked to select the appropriate Priority Programme call during both the registration and the proposal process.

If you would like to submit a proposal for a new project within the existing Priority Programme, please go to Proposal Submission – New Project – Priority Programmes and select “SPP 1881” from the current list of calls. Previous applicants can submit a proposal for the renewal of an existing project under Proposal Submission – Proposal Overview/Renewal Proposal.

In preparing your proposal, please review the programme guidelines (form 50.05, section B) and follow the proposal preparation instructions (form 54.01). These forms can either be downloaded from our website or accessed through the elan portal. In addition to submitting your proposal via elan, please send an electronic copy to the programme coordinator.

The envisaged start of funding is October/November 2019.

Further Information

More information on the Priority Programme is available under:
www.tu-ilmenau.de/turbosp

The elan system can be accessed at:
<https://elan.dfg.de/en>

DFG forms 50.05 and 54.01 can be downloaded at:
www.dfg.de/formulare/50_05
www.dfg.de/formulare/54_01

For scientific enquiries please contact the Priority Programme coordinator:
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