

Call for Proposals

No. 16

20 April 2018

Priority Programme “Dynamic Wetting of Flexible, Adaptive and Switchable Surfaces” (SPP 2171)

In March 2018, the Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) established the Priority Programme “Dynamic Wetting of Flexible, Adaptive and Switchable Surfaces” (SPP 2171). The programme is designed to run for six years. The present call invites proposals for the first three-year funding period.

The dynamic process of liquids wetting or dewetting various substrates is ubiquitous in everyday life and of key importance in many technological applications. Existing work mostly focusses on the influence of the topography and composition of rigid and inert substrates. Recent developments in areas like microelectronics and 3D printing have demonstrated a pressing need to also understand cases in which (de)wetting dynamics and substrate dynamics are strongly coupled. This holds true especially on microscopic and mesoscopic length scales, where (non)equilibrium surface phenomena dominate.

The Priority Programme aims at establishing a deeper understanding of the fundamental physics behind the dynamic (de)wetting of flexible, adaptive and switchable substrates combining experimental and theoretical perspectives. The focus lies on rather simple liquids that shall be employed to investigate the different cases of strong coupling between liquid hydrodynamics and (primarily reversible) substrate dynamics. This will further develop the foundations for future technologies that utilise and control such wetting phenomena.

- Flexible substrates experience deformations due to the traction that a (de)wetting liquid exerts on them, which in turn experiences an altered geometry. Thus, static and dynamic (de)wetting processes are governed by this two-way coupling between liquid and substrate. This holds true for elastomeric materials, hydrogels, or slippery liquid infused porous surfaces, and is even amplified for substrates that expose “hairy” structures.
- In contrast, adaptive substrates change their physico-chemical properties due to the presence of a liquid. This may be induced by direct contact like under a sessile droplet, or it may be mediated through an external phase like the ambient atmosphere or a second liquid. Typical modification agents are temperature or ambient humidity. The functional surfaces of many carnivorous plants belong to this category, as well as swellable polymer gels or surfaces with grafted polymer brushes.

- Finally, switchable substrates alter their surfaces upon exposure to an external influence. For instance, switching could be induced by electric or magnetic fields, as well as via changes of pH or temperature. For instance, nematic elastomers or coatings that contain photoswitchable azobenzenes fall into this category.

Often, real model systems cannot be clearly assigned to a single category, but exhibit features of several of them. The common base of all three categories is a strong coupling between (de)wetting hydrodynamics and substrate processes. This typically introduces additional time- and length scales that do not exist in the (de)wetting of inert and rigid substrates. Strong couplings also impact the mechanisms of energy dissipation, potentially altering the dynamics on a global scale. To not hide these coupling mechanisms behind the physics of truly complex liquids, projects shall focus on rather simple, low-molecular-weight liquids. This includes the mixtures of such liquids and dilute suspensions or tenside solutions that offer novel coupling mechanisms through their internal degrees of freedom.

This Priority Programme invites experimental, numerical, and theoretical contributions from all natural sciences and mathematics. Projects should aim at a fundamental understanding of the dynamics of three-phase contact lines on flexible, adaptive or switchable substrates. To keep the programme coherent, it shall not support projects that exclusively aim at application development. Also, the focus shall be on the coupling of liquid and substrate dynamics, for liquids that as such are already well understood. This excludes projects aiming at understanding biological liquids and liquids that exhibit strong structuring in their bulk. Furthermore, the substrate dynamics shall normally be reversible which, e.g., excludes processes based on irreversible chemical reactions or permanent mechanical change. The questions that are addressed in the programme are highly interdisciplinary, reaching from materials science to theoretical physics of liquids. Both, experimentalists and theoreticians, face the challenges of phenomena that are inherently multiscale, where physico-chemical processes at the microscale determine the evolution on the macroscopic scale.

Proposals must be written in English and follow the proposal preparation instructions (form 54.01). They have to be submitted to the DFG via the DFG's electronic proposal submission system "elan" by **15 October 2018**. Please select "Schwerpunktprogramm" and "SPP 2171" when submitting your proposal. Applicants must be registered in elan prior to submitting a proposal to the DFG. If you have not yet registered, please note that you must do so by **7 October 2018** to submit a proposal under this call. In addition to submitting your proposal through elan, please send an electronic copy to the programme coordinator.

Researchers considering to submit proposals should contact the coordinator prior to submission to ascertain that proposals fit into the scientific scope of the programme. They are also asked to send an outline of their project (PDF file) to the coordinator and the DFG office (Dr. Cosima Schuster) by 16 July 2018. The one-page document should briefly describe the main subject of the planned proposal. The submission is voluntary and non-committal. To allow potential participants to inform themselves about the research concept of the programme and to discuss research plans, collaborations and joint proposals, a preparation meeting takes place on 17 and 18 May 2018 at WWU Münster. For details and registration (deadline 2 May 2018) see the link below.

The review colloquium for the Priority Programme is planned for 7 and 8 February 2019 in Mainz.

Further Information

More information on the preparation meeting for the Priority Programme is available under:
www.uni-muenster.de/CeNoS/Veranstaltungen/Tagung1

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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Questions on the DFG proposal process can be directed to:
Programme contact: Dr. Cosima Schuster, phone +49 228 885-2769, cosima.schuster@dfg.de
Administrative contact: Makemba Mayimona, phone +49 228 885-2316, makemba.mayimona@dfg.de

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