Universität Stuttgart

Press Release
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Double success for the University of Stuttgart

DFG approves funding for two special research fields

On 24th November 2017 the German Research Foundation (DFG) approved setting up a new special research field (SFB) at the University of Stuttgart. The new SFB 1313 entitled "Interfacial driven multi-field process in porous media" dedicates itself to the flow, transport and deformation processes of liquids and gases in porous materials. In the same meeting the DFG extended the funding for the transregional special research field "Drop dynamic processes under extreme environmental conditions" (SFB-TRR 75), that was already established in 2010, by a further four years.

The Rector of the University of Stuttgart, Professor Wolfram Ressel, commented on the decision by the DFG by expressing his pleasure, "With the physical-numeric treatment of porous media the SFB 1313 is supplementing in an outstanding way the focal point "Simulation and Modelling" as well as the overarching profile sector "Intelligent systems for a sustainable society" at the University of Stuttgart and in this framework will realise highly topical fundamental collaborative research. This also applies to the Transregio SFB-TRR 75, the extension of which confirms the very successful work of the first two funding periods. Overall, there are now 12 DFG special research fields established at the University of Stuttgart, of which eight in the role of spokesperson. This once again confirms the quality of our researchers as well as the high scientific topicality of their work."

SFB 1313 "Interfacial drive multi-field processes in porous media – flow, transport and deformation"

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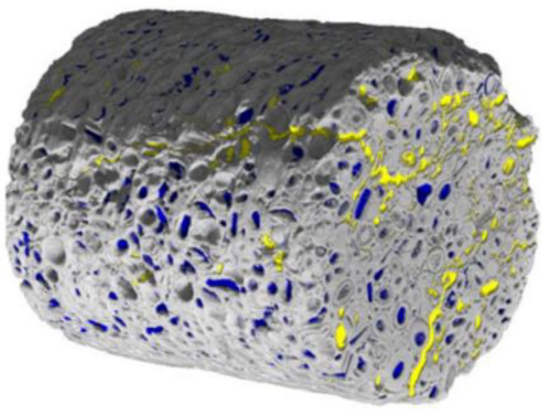
How liquids or gases (fluids) spread in porous media, for example in rocks, and to which deformations this leads plays a role in very many fields of application. Examples of this are the optimisation of fuel cells, the storage of carbon dioxide or methane underground, the prediction of landslides after heavy rain or the transport of medicaments in human tissues.



Microcomputer tomography recording of a porous media with two fluid phases. Image: University of Stuttgart / IWS

The special research field (SFB) 1313 has set itself the target of developing a fundamental understanding of how the interfaces – for example between two fluids or between the fluid and a solid material – influence flow, transport and deformation in porous media. On the one hand it should be quantified which influencing factors like pore geometry, the heterogeneity and cracks in the porous medium have on the dynamics of the flow processes. On the other hand mathematical and numerical models should be developed with which the impacts of processes that take place on very many small scales can be integrated into flow simulations.

At the centre of the research there are three representative fields. Project field A treats complex exchange processes of mass, impulse and energy at the border of porous medium and air flows as they occur, for example, when water evaporates in air. Project field B makes complex crack and failure processes in porous media the subject of discussion.

Project field C deals with changes in the pore space on the basis of processes at the interface between fluid and solid material phase. This is the case, for example, when salt precipitates in the ground and the pore spaces are minimised through this, thus leading to suppression processes.

The research combines mathematical and numeral modelling with multi-scale, image-based experiments. In another, superordinate project field the focus will be on visualising the simulation and experimental results, to validate the models and to link multi-physics and multi-scale simulation environments. In addition, a new graduate school is to be set up in the framework of the SFB.

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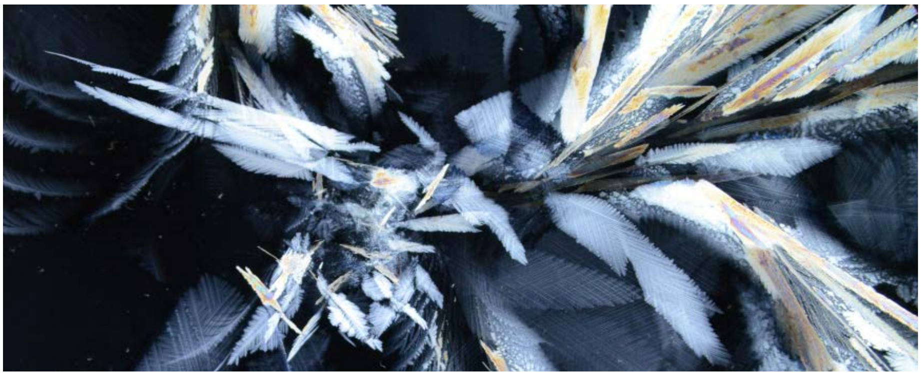
SFB-TRR 75 "Drop dynamic processes under extreme environmental conditions"

Spokesperson: Professor Bernhard Weigand, Institute for Thermodynamics of Aerospace from the University of Stuttgart.

In Transregio 75 researchers from the University of Stuttgart cooperate with the Technical University of Darmstadt, the German Aerospace Centre (DLR) in Lampoldshausen and the University of Paderborn, whose current associated sub-project will be incorporated in the association now with the extension. Drops play a central role in many areas of nature and technology. The fundamental understanding of drop dynamics processes is hereby decisive for the improvement of technical systems or for the better prediction of natural processes. Many of these processes occur under extreme environmental conditions and are already being used in technology, although there are still large gaps in the fundamental understanding of the processes.



Dendritic structures grow in undercooled water and influence processes in clouds. Photo: University of Stuttgart / ITLR

This is where the SFB-TRR 75 comes into play. The aim is acquiring a more profound physical understanding of these processes. Based on this, methods of analytical and numerical description of these processes are shown and these are naturally also implemented. In addition an improvement of larger systems in nature or in technical systems is enabled through this.

The knowledge acquired is applied in an exemplary way on five selected systems as "guiding examples". This includes, among other things, the impact of undercooled drops on aircraft components, the behaviour of fuel sprays in future combustion systems or the phases transitions on undercooled and potentially charged drops in clouds. Through the sub-project of the University of Paderborn joining, molecule dynamic simulations for the better understanding of detailed processes will also play a greater role in future, for example in the drop evaporation near the critical point and in the case of drop collisions.

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