

Call for Proposals

No. 25

4 April 2023

Priority Programme “2D Materials – Physics of van der Waals [hetero]structures (2DMP)” (SPP 2244)

In 2019, the Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) established the Priority Programme “2D Materials – Physics of van der Waals [hetero]structures (2DMP)” (SPP 2244). The programme is designed to run for six years. The present call invites proposals for the second three-year funding period.

Two-dimensional (2D) materials are crystals with a thickness of only one or very few atoms. After the discovery of graphene, the most prominent representative of this class of materials, many other 2D crystals have been identified, often with intriguing properties that have no counterparts in three-dimensional solids.

Furthermore, stacking 2D crystals in a well-defined manner can result in new states of matter, even if the individual layers are only weakly bound by van der Waals (vdW) interaction. The most striking example, published in 2018, is the transformation of bilayer graphene into a superconductor if the layers are twisted by a “magic angle” of about 1.1 degrees. Such a delicate structure manipulation has become possible thanks to the massive efforts invested in researching graphene-related materials. It opens the door to the investigation of phase transitions imposed by the so-called proximity effect, for example between Mott insulator and unconventional superconducting state, to a 2D ferromagnetic phase, or semiconductor-metal transitions. In addition, vdW heterostructures offer rich optical and optoelectronic properties, such as interlayer excitons and trions. The combination of 2D crystals with different properties, e.g. a 2D superconductor and a 2D topological insulator, may enable exotic physical phenomena such as Majorana fermions. The goal of the Priority Programme is to bundle the research efforts and expertise in the German scientific community to address the many open fundamental questions of stacked 2D materials.

All proposals shall address the exploration of 2DMP’s fundamental research goal: to explore and to deeply understand the physical phenomena in 2D vdW materials that are emerging from interlayer interactions, Moiré superstructures and/or proximity effects. Each project shall advance at least one of the following three research areas:

- electronic properties and transport (including moiré physics, effects of interlayer interactions on the electronic properties, charge and spin transport as well as strain and doping effects)
- optical and optoelectronic effects (including spin-valley-physics, exciton and trion physics, optical properties emerging from interlayer interactions in 2D vdW materials)

- collective and correlated phenomena (including spin, magnetic and superconducting proximity effects, Mott insulators) and novel topological states emerging in 2D vdW [hetero]structures

The following topics will not be covered by the Priority Programme:

- individual 2D crystals such as graphene, transition metal chalcogenides or topological insulators, including those that are encapsulated for protective reasons only
- research on defect properties
- mass transport and intercalation in 2D vdW systems
- applications in catalysis, including photocatalysis, and synthetic approaches to 2D materials
- the interaction of 2D crystals with molecules or with substrates
- functionalised 2D crystals
- devices and circuitries, including thermal and thermoelectric ones, if not required for studying fundamental physical properties of vdW [hetero]structures

In order to achieve maximum diversity, it is expected that each principal investigator (PI) be involved only in one proposal. Applications for proposals covering more than one research area are encouraged and can be either individual or consortial proposals (2 to 3 PI).

Proposals must be submitted to the DFG by **28 June 2023**. Please note that proposals can only be submitted via the elan portal, the DFG's electronic proposal processing system. To enter a new project within the existing Priority Programme, go to Proposal Submission – New Project/Draft Proposal – Priority Programmes and select “SPP 2244” from the current list of calls.

All proposals have to be written in English and prepared according to the programme guidelines (DFG form 50.05, section B) and the proposal preparation instructions (DFG form 54.01). These forms can either be downloaded from our website or accessed through the elan portal. In addition to submitting your proposal through elan, please send an electronic copy to the programme's coordination office. Please make sure to use the latest DFG templates for the Proposal Preparation Instructions and CV when submitting the proposal.

Applicants without an existing elan account 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 **14 June 2023** to submit a proposal under this call; registration requests received after this time cannot be considered. 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 submission.

The proposals will be evaluated during a review colloquium scheduled for 30-31 October 2023 at the Physikzentrum in Bad Honnef.

Further Information

More information on the Priority Programme and the 2DMP symposium is available under: <https://2dmp.tu-dresden.de>

The Priority Programme coordination office can be contacted at:

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For scientific enquiries please contact the Priority Programme coordinator:

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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

Questions on the DFG Priority Programme and proposal submission can be directed to:

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