

Rhine-Main Universities submit EXC proposals

Next successful step in the Excellence Strategy

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In the Excellence Strategy of the German federal and state governments, the Rhine-Main Universities (RMU) have submitted the full proposals in the Excellence Cluster (EXC) funding line, for which the submission deadline expired today. The expert committee of the German Research Foundation (DFG) had invited four of the cluster initiatives newly submitted by the Rhine-Main Universities to submit full proposals. The Rhine-Main Universities also submitted two follow-up proposals.

Prof. Dr. Georg Krausch, President of Johannes Gutenberg University Mainz and the current RMU spokesperson said: “The submission of the full proposals in the Excellence Cluster funding line is another important step in the Excellence Strategy. I would like to thank all those involved who worked extremely hard on the applications over the past months and did everything they could to ensure that we were able to submit outstanding proposals today. I am very proud of the extraordinary achievements and the remarkable commitment of all RMU members involved. We are now looking forward to presenting the research strength of the Rhine-Main area to the reviewers from October onwards.” The decision as to which Clusters of Excellence will receive funding from 2026 onwards will be issued on 22 May 2025.

Krausch added: „Competition is strong in the German science landscape. However, the success we had so far in the Excellence Cluster funding line is a clear confirmation to us as the Rhine-Main Universities that, as an alliance, we achieve unique results across all performance dimensions through our long-standing and value-adding cooperation. As RMU, we are already working on the next steps to further strengthen our alliance.”

Overview of the cluster projects at the three universities

Technical University (TU) of Darmstadt submitted full proposals for a total of three cluster initiatives. In addition to the research collaboration CoM2Life led by Johannes Gutenberg University Mainz (JGU), the projects are Reasonable Artificial Intelligence (RAI) led by TU Darmstadt and The Adaptive Mind (TAM), a joint proposal of Justus Liebig University Giessen and Philipps University Marburg.

Reasonable Artificial Intelligence (RAI)

Over the past decade, deep learning (DL) has driven groundbreaking advances in artificial intelligence (AI). However, current DL-based AI systems are unreasonable in many ways: They require considerable

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resources, they struggle with reasoning, handling unfamiliar situations, they do not improve continuously, learn through interactions, or adapt quickly. The Cluster of Excellence Reasonable Artificial Intelligence therefore aims to develop a new generation of AI, Reasonable Artificial Intelligence (RAI). This new generation learns in a more 'reasonable' way than current systems by training models in a modular fashion, allowing them to continuously improve and build abstract world knowledge, and, equipped with common sense, they will have an inherent ability to reason, interact, and adapt to their surroundings.

The Adaptive Mind (TAM)

The project "The Adaptive Mind" aims to understand the fundamental processes behind human perception, thought and behaviour that allow us to adapt to constantly changing conditions. The collaboration between the Justus Liebig University Gießen, Philipps University Marburg and TU Darmstadt brings together researchers from the fields of psychology, cognitive science and neuroscience with experts in artificial intelligence (AI), machine learning and robotics to decode the universal principles behind human adaptability. The findings from the project will be integrated into computer models that can imitate, predict and explain both the spectacular successes and also tragic limits of the human mind – and will also have an impact on basic research, mental health and the development of safe AI and robot technology.

Johannes Gutenberg University Mainz submitted a joint full proposal with TU Darmstadt for the cluster project CoM2Life as well as a follow-up proposal for the PRISMA⁺⁺ Cluster of Excellence.

Communicating Biomaterials: Convergence Center for Life-like Soft Materials and Biological Systems (CoM2Life)

CoM2Life is a joint Cluster of Excellence proposal by Johannes Gutenberg University Mainz (JGU), the Technical University of Darmstadt, and the Max Planck Institute for Polymer Research. The initiative seeks to develop a revolutionary new generation of soft biomaterials inspired by the principles of living systems, capable of permanent and reciprocal interactions with living cells and tissues. By integrating the chemistry-centered design of biomaterials with the regulatory circuits of synthetic biology, the project aims to create intelligent biomaterials that can selectively detect environmental signals, process them internally, and precisely control effectors. This innovative approach promises to revolutionize medical research, enabling the development of feedback-controlled materials for the targeted release of drugs and biological agents, such as in cancer immunotherapy and tissue regeneration. It will also pave the way for new tissue models to replace animal testing and, ultimately, for the creation of artificial organs. To address public perception challenges in this pioneering field, communication science experts are involved in the project, working to understand the spread of misinformation and ensure responsible dialogue with the public about these scientific advancements.

Precision Physics, Fundamental Interactions and Structure of Matter (PRISMA⁺⁺)

PRISMA⁺⁺ is the title of the follow-up proposal for the Cluster of Excellence "Precision Physics, Fundamental Interactions and Structure of Matter" (PRISMA⁺). The proposal is being submitted jointly by JGU's Institute of Physics and Institute of Nuclear Physics, together with the Helmholtz Institute Mainz. The purpose of this cluster is to explore the existence of a "new physics" beyond that of the Standard Model of

particle physics. There are three main factors underlying the research into the limitations of the Standard Model. These are the extent of synergy between theory and experiment, the availability of state-of-the-art facilities on the campus and wide-ranging international collaboration. Among the core features of the cluster is the construction and operation of the particle accelerator MESA (Mainz Energy-recovering Superconducting Accelerator) that will enable the results of high-precision experiments to be compared with the predictions of theoretical physics. In this new funding period, the cluster is proposing to also investigate aspects of physics at high and low energies with the intention of identifying new particles and phenomena. In addition, the study of the properties of neutrinos is to be intensified. The work of the cluster will continue to receive significant support through the research program of the Mainz Institute of Theoretical Physics (MITP) and the development of hardware by the PRISMA Detector Lab. The Mainz Physics Academy will furthermore remain the umbrella body responsible for all activities relating to the training and career planning of the associated young researchers.

Goethe University Frankfurt submitted a full proposal for the cluster initiative SCALE as well as a follow-up proposal for the existing Cluster of Excellence Cardio-Pulmonary Institute (jointly with Justus Liebig University Giessen).

SCALE: Subcellular Architecture of Life. Cells consist of billions of molecules that are organized from single molecules to large molecular complexes to organelles. Although the functions of many individual molecules are known, it often remains unclear how the architecture inside a cell develops and functions, and how the parts interact. In addition to uncovering the cell's self-organization principles, the scientists at SCALE also want to create a simulation of the cell with high spatial and temporal resolution. This, they hope, will lead to a better understanding of how cells really function and how their various "machines" interact.

CPI: Cardio-Pulmonary Institute. Diseases of the cardiovascular system often go hand in hand with lung diseases, and are the most common causes of death worldwide. The Cluster of Excellence seeks to understand which molecular biological processes underlie these organs' functioning as well as their failure in diseases. To find new therapeutic approaches, CPI scientists are developing cross-university model systems, ranging from cell cultures to animal models, and combining the results with examination data from patients. The cluster received funding as the "Excellence Cluster Cardio-Pulmonary System" from 2006 to 2018 and was again awarded the title of Cluster of Excellence Cardio-Pulmonary Institute in 2019.

The Rhine-Main Universities (RMU)

Goethe University Frankfurt am Main, Johannes Gutenberg University Mainz and Technical University of Darmstadt make up the RHINE-MAIN-UNIVERSITIES (RMU). The universities have a combined total of more than 95,000 students and 1,500 professors and cooperate closely in research, studying and teaching. These renowned research universities are shaping the Frankfurt-Rhine-Main region as an internationally visible academic hub.