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Saxony Bundles Expertise in the Field of Nuclear Fusion

EU and Free State Provide €2.4 Million in Funding for SAXFUSION Network

With SAXFUSION, Saxony launches its first state-wide competence network for future technologies in nuclear fusion. The aim is to advance fusion as a clean, safe, and base-load capable energy source, to build strategic expertise, and to make the results available to industry and society. The Helmholtz-Zentrum Dresden-Rossendorf (HZDR) coordinates the project. The Fraunhofer Institute for Material and Beam Technology IWS co-leads the project. Other renowned Saxon research institutions participate as well. In addition, SAXFUSION integrates major international projects and industrial partners through cooperation agreements. The European Union and the Free State of Saxony support the project with around €2.4 million euros from the European Regional Development Fund (EFRE).

Controlled fusion of atomic nuclei offers the long-term possibility of ensuring a sustainable, emission-free energy supply. Various approaches are available for this purpose, most of which aim to generate and control a so-called plasma in which electrons and atomic nuclei can move freely and independently of one another—just like inside our sun. Leading international institutions such as ITER in southern France, Lawrence Livermore National Laboratory (LLNL) in the USA, and Wendelstein-7X in Germany have already achieved significant technological advances. Nevertheless, numerous questions remain unanswered, for example regarding the long-term stability of materials exposed to plasma, or for the efficient control of the fusion process. This is precisely where SAXFUSION takes action.

The network aims to serve as a central point of contact for partners from research, industry and society who are interested in fusion as a potential research and business area and who require in-depth information on the subject. With the expertise of its partners from cutting-edge research, industry, and universities in central Germany the network contributes directly to Germany’s high-tech agenda. During a three-year development phase, the SAXFUSION team will identify and link existing expertise in Saxony. It will also specifically add competences, for example by establishing new collaborations and long-term research and development strategies. SAXFUSION starts with four central areas of expertise: laser and optical technologies, development of fuel capsules including the diagnostics of the fusion reaction, research into reactor materials, and comprehensive simulations and data analyses.

SAXFUSION supports the goals of the action plan to accelerate commercial fusion deployment in Germany that the Federal Ministry of Research, Technology, and Space has recently presented: from the construction of large-scale infrastructure, to the establishment of a complete value chain including the development of new business models, to the training of young professionals. Excellent basic research establishes the indispensable basis for developing the technologies and processes needed for the subsequent construction and safe operation of fusion power plants.

HZDR Takes over Strategic Management and Networking
Dr. Michael Bussmann's group of Computational Radiation Physics at HZDR coordinates the new network. At the Helmholtz center, the Center for Advanced Systems Understanding (CASUS) in Görlitz and the Institute of Radiation Physics in Dresden are involved. "With SAXFUSION, we bring together Saxony's diverse expertise in fusion technology for the first time," explains Bussmann. "Our goal is to raise awareness of Saxony's expertise in this future-oriented industry and to participate in international development projects." The HZDR has built an international reputation in plasma experiments and material testing, in research with high-power lasers, and in the development of computer simulations and artificial intelligence for plasma research.

The SAXFUSION network links via the Helmholtz center to major European research infrastructures such as the European XFEL and the Extreme Light Infrastructure, as well as international fusion research centers such as ITER, LLNL and Wendelstein-7X. The Scientific Director of the HZDR, Prof. Sebastian M. Schmidt, emphasizes: "SAXFUSION fits perfectly with our mission to strengthen Saxony as a location for business by combining basic and applied research. Innovations arise through the interaction of various players in networks. And with the establishment of the new SAXFUSION network, we will succeed in developing globally relevant innovations in Saxony. I have every confidence in that."

Fraunhofer IWS Makes Technology Transfer a priority
As the project's co-leader, Fraunhofer IWS is responsible for transferring the technology into industrial practice. The institute offers unique manufacturing technology, process and material expertise, and access to industry networks. Companies, especially small and medium-sized enterprises, benefit directly from this transfer potential. "The development of fusion energy is one of the greatest challenges of our time," emphasizes Prof. Christoph Leyens, Director of Fraunhofer IWS. "Together, we will develop technologies that open up new markets and strengthen Saxony's industrial companies internationally."

In addition to the two coordinators, HZDR and Fraunhofer IWS, SAXFUSION also includes other excellent research partners from Saxony (see info box). Industry partners and start-ups such as Amplitude (France), Marvel Fusion, and Focused Energy (both Germany) have already agreed to actively support the network's work. The network also maintains close links to national initiatives of the German Federal Ministry of Research, Technology and Space, and to European research programs (EURATOM, EuroHPC Center of Excellence Plasma-PEPSC).

SAXFUSION is financed by the European Regional Development Fund (EFRE) and by fiscal resources based on the budget approved by the Saxon State Parliament. The EFRE contributes to economic, social, and community cohesion by helping to balance regional differences within the EU. Saxony will receive around €1.95 billion from the EFRE for 2021 to 2027 funding period.

Info box

Overview of Project Partners

- **Center for Advanced Systems Understanding (CASUS) and Institute for Radiation Physics at Helmholtz-Zentrum Dresden-Rossendorf (HZDR):** project management, coordination, high-power lasers, plasma and materials research, networking with international fusion projects
- **Fraunhofer Institute for Material and Beam Technology IWS:** co-project management, technology transfer, plant and process engineering, industrial application, and series production
- **University of Applied Sciences Mittweida:** expertise in high-power lasers, micro- and nano-machining, additive manufacturing processes for fusion technologies
- **University of Applied Sciences Zittau-Görlitz:** expertise in energy technology, electrical engineering, high-current and high-voltage technology, simulation systems
- **Dresden University of Technology (TUD):** neutron generator, neutron spectroscopy, nuclear engineering training, laser and materials technology
- **Leibniz Institute for Solid State and Materials Research Dresden (IFW):** development of new materials for reactor components, processing technologies, materials analysis
- **Leibniz Institute of Surface Engineering Leipzig (IOM):** surface processing, precision optics, technologies for shaping and smoothing optical components

Additional Information:

Dr. Michael Bussmann | Group leader „Computational Radiation Physics”
Center for Advanced Systems Understanding (CASUS) at HZDR
email: m.bussmann@hzdr.de

Claudia Keibler-Willner | Network Manager SAXFUSION
E-Mail. c.keibler-willner@hzdr.de

Prof. Dr. Christoph Leyens | Director Fraunhofer Institute for Material and Beam Technology IWS
email: christoph.leyens@iws.fraunhofer.de

Media Contacts:

Dr. Martin Laqua | Officer Communications, Press and Public Relations
Center for Advanced Systems Understanding (CASUS) at HZDR
cell phone: +49 1512 807 6932 | email: m.laqua@hzdr.de

Dipl.-Soz. Wiss. Markus Forytta | Head of Corporate Communications
Fraunhofer Institute for Material and Beam Technology IWS
phone: +49 351 83391 3614 | email: markus.forytta@iws.fraunhofer.de

About the Center for Advanced Systems Understanding

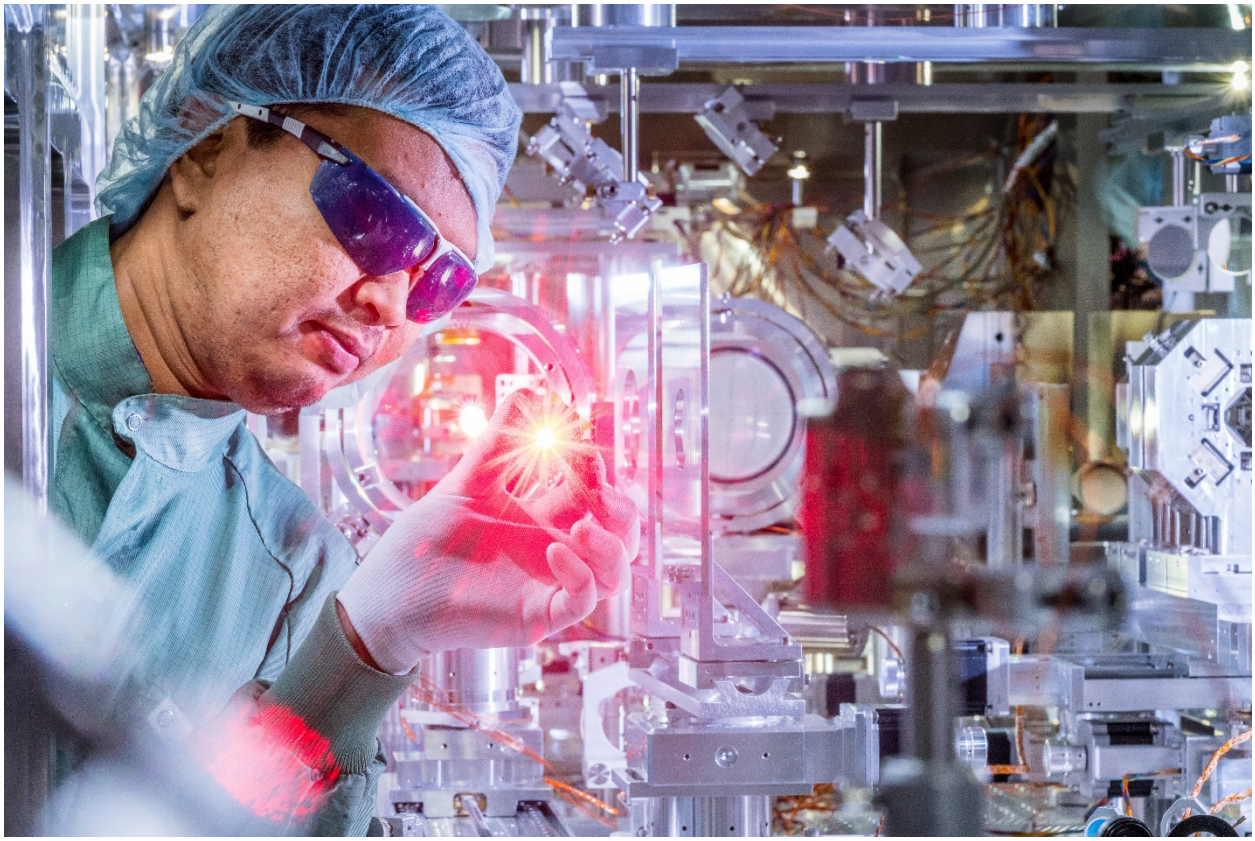
CASUS was founded 2019 in Görlitz/Germany and pursues data-intensive interdisciplinary systems research in such diverse disciplines as earth systems research, systems biology or materials research. The goal of CASUS is to create digital images of complex systems of unprecedented fidelity to reality with innovative methods from mathematics, theoretical systems research, simulations as well as data and computer science to give answers to urgent societal questions. The founding partners of CASUS are the Helmholtz-Zentrum Dresden-Rossendorf (HZDR), the Helmholtz Centre for Environmental Research in

Leipzig (UFZ), the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden (MPI-CBG), the Technical University of Dresden (TUD) and the University of Wrocław (UWr). CASUS, managed as an institute of the HZDR, is funded by the German Federal Ministry of Research, Technology and Space (BMFTR) and the Saxon State Ministry for Science, Culture and Tourism (SMWK). *www.casus.science*

About the Fraunhofer Institute for Material and Beam Technology IWS

Materials and Lasers – Competence with a System: The Fraunhofer Institute for Material and Beam Technology IWS develops complex system solutions in materials and laser technology. We define ourselves as idea drivers developing customized solutions based on laser applications, functionalized surfaces as well as material and process innovations – from easy-to-integrate custom solutions to cost-efficient solutions for small and medium-sized enterprises to industry-ready one-stop solutions. Our research focuses on aerospace, energy and environmental technology, automotive, medical and mechanical engineering, toolmaking, electrical engineering and microelectronics, and photonics and optics sectors. In our five future and innovation fields of battery technology, hydrogen technology, surface functionalization, photonic production systems and additive manufacturing, we are already creating the basis today for the technological answers of tomorrow.

Images and Captions



SAXFUSION connects cutting-edge research in Saxony to advance fusion energy. Laser and materials technologies play a key role in future reactor concepts.

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