Forschungsfabrik Mikroelektronik Deutschland

FRAUNHOFER GROUP FOR MICROELECTRONICS IN COOPERATION WITH LEIBNIZ FBH AND IHP

PRESS RELEASE

Research Fab for quantum and neuromorphic computing: Launch of the Germany-wide cooperation FMD-QNC

In order to consolidate and expand the existing microelectronic research and development in Germany regarding quantum and neuromorphic computing, the FMD launched on December 1, 2022, a joint project together with four other Fraunhofer institutes, the Jülich Forschungszentrum and AMO GmbH: The Research Fab Microelectronics Germany — Module Quantum and Neuromorphic Computing (FMD-QNC). The German Federal Ministry of Education and Research is funding the equipment and structural setup required for the project.

The performance limits of classical digital computers are increasingly being challenged by compute-intensive technologies and applications such as artificial intelligence (AI), edge computing, and the optimization of complex systems. Evidence of this can be found, for instance, in simulations used in chemistry and pharmaceuticals to speed up the development of new medications and vaccines, in the process optimization of complex production lines, as well as in the area of traffic and freight transport. A promising approach to solving this challenge is offered by quantum computing (QC) and neuromorphic computing (NC). They are considered the essential foundations for Next Generation Computing, i.e. for novel computing technologies essential for the realization of many competitive and safety-critical future applications.

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de

Contributing to the development of the future hardware foundation for novel computing technologies with the FMD-QNC

In Germany, several fundamental research projects are currently working on QC and NC. Nevertheless, there are still insufficient opportunities for application-oriented testing of the hardware developments that are required for the highly complex computing technologies, as well as for a rapid implementation of the results in prototypes and small series. In order to provide researchers and industry with optimal support in the development of customized microelectronics as well as with scalable manufacturing and integration processes for the new computing technologies, the Research Fab Microelectronics Germany (FMD for its acronym in German) will be expanded to include the module Quantum and Neuromorphic Computing (QNC). To that purpose, the Fraunhofer institutes IMWS, IOF, IPM, and ILT, together with the Jülich Forschungszentrum and AMO GmbH, are cooperating to enhance the facility parks and diverse production lines of the participating partners, as well as the entire spectrum of expertise of the 13 FMD institutes.

The FMD provides customized microelectronics solutions along with scalable manufacturing and integration processes for QC and NC

Based on the cross-organizational and cross-site expertise generated within the FMD, it will be feasible to implement the envisaged FMD-QNC project in a target-oriented and efficient manner. Aiming to create a high-level holistic research structure for novel computing technologies, the cooperating partners will be gradually equipped over the next three years with design tools, measurement and characterization techniques as well as manufacturing facilities required for application-oriented research into highly complex QC and NC technologies.

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de

The research structures will be interconnected to achieve industry-oriented research and pilot lines, among others for superconducting and memristive circuits, 3D system integration and highly integrated beam sources. As a result, it is intended to develop solutions for the — often extreme — operating environments, such as vacuum, cryogenic temperatures or electromagnetic shielding. This will set the process and technological requirements for design, fabrication and characterization of chips for neuromorphic computing as well as various QC technologies (superconducting, neutral atom, trapped ion, and quantum dot based).

Industry-relevant research framework and low-threshold access to research infrastructure

Besides the research activities and the application-oriented testing of the resulting developments, there are two further components of the overall FMD-QNC project: the QNC operating model and the Microelectronics Academy. On the one hand, the Microelectronics Academy envisaged here aims to raise the awareness of the upcoming generation of specialists in the field of microelectronics at an early stage, as well as to provide basic training and continuing education for experts who are already active in the field. On the other hand, "the so-called QNC operating model intends to comprise a flexible and low-threshold access model for partners from both science and industry enabling them to react agilely to the ongoing new developments and the requirements from research and development as well as to accelerate the transfer into the industry. For this purpose, three specific project corridors will be created: technology development, pilot production and preliminary research. Furthermore, it is planned to reinforce networks with diverse user groups along with selected complementary research activities to integrate the technologies into the research structures. This includes a QNC space for testing special manufacturing methods, the so-called multi-project technologies as

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de

simplified access to chip manufacturing runs, and an open design platform," explains Dr. Oliver Pyper, project manager of FMD-QNC.

Networking among European research organizations to address current and future challenges in electronics research

At the European level, the FMD-QNC is complemented by the PREVAIL project (Partnership for Realization and Validation of AI hardware Leadership), which started on December 1, 2022 as well. The PREVAIL project is bringing together four European research organizations — CEA-Leti, Fraunhofer, imec and VTT — to establish a networked 300 mm technology platform for the fabrication of chip prototypes used in advanced artificial intelligence and neuromorphic computing applications. The national part of PREVAIL is constituted by the four Fraunhofer institutes EMFT, IIS, IPMS and IZM, which as part of the FMD are broadening their 300 mm fabrication, design and test facilities as well as deploying them in a complementary way to the 300 mm technology of their European research partners. The intended project activities within PREVAIL and FMD-QNC will be synergetically interconnected and represent an essential preparatory work for the technological foundation of the European Chips Act. The European Commission's set of measures aims to boost the development of semiconductor technology to a new level and to increase Europe's innovative strength in microelectronics.

The FMD-QNC cooperation partners

AMO GmbH, Forschungszentrum Jülich GmbH, Fraunhofer EMFT, Fraunhofer ENAS, Ferdinand-Braun-Institut gGmbH, Leibniz-Institut fuer Hoechstfrequenztechnik (FBH), Fraunhofer FHR, Fraunhofer HHI, Fraunhofer IAF, Leibniz Institute for High Performance Microelectronics (IHP), Fraunhofer IIS, Fraunhofer IISB, Fraunhofer IMS, Fraunhofer IMWS, Fraunhofer IOF, Fraunhofer IPM, Fraunhofer IPMS, Fraunhofer ILT, Fraunhofer ISIT, Fraunhofer IZM.

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de

FRAUNHOFER GROUP FOR MICROELECTRONICS IN COOPERATION WITH LEIBNIZ FBH AND IHP

Research Fab for quantum and neuromorphic computing: Germany-wide cooperation *FMD-QNC* was launched to develop the future hardware foundation for novel computing technologies. © Fraunhofer MIKROELEKTRONIK

moduleqnc
quantum & neuromorphic computing

© Fraunhofer MIKROELEKTRONIK

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de

About the Research Fab Microelectronics Germany (FMD)

For the first time, eleven institutes of the Fraunhofer Group for Microelectronics and the two Leibniz institutes FBH and IHP have been combining their expertise within the framework of the FMD since 2017 in order to achieve and expand a new quality level in the research, development and (pilot) production of semiconductor-based micro- and nanosystems. With more than 2,000 scientists, the FMD is one of the largest and world-leading R&D associations for micro and nanoelectronics applications and systems in Europe. As a global driver of innovation, the FMD provides a unique range of expertise and infrastructures, while contributing to Germany and Europe's leading position in research and development. This implies bridging the gap between basic research and cross-technology solutions, right through to customer-specific product development. The German Federal Ministry of Education and Research provided funding for the modernization of the research infrastructure of the thirteen participating institutes from 2017 to 2021.

Press contact Akvile Zaludaite, Senior Manager Corporate Communications
Email akvile.zaludaite@mikroelektronik.fraunhofer.de | Mobile +49 162 2910 640
Anna-Louisa-Karsch-Straße 2 | 10178 Berlin | www.forschungsfabrik-mikroelektronik.de