Virtual Guest Student Programme 2022

In summer 2022, JSC is once again offering a virtual guest student programme supported by the Centre Européen de Calcul Atomique et Moléculaire (CECAM). Within this programme, students with a major in natural sciences, engineering, computer science, or mathematics get the opportunity to familiarize themselves with different aspects of scientific computing. Together with local scientists, the participants work on a range of current topics in research and development. Assignments can be chosen from different areas depending on the participants' previous knowledge and interests. These areas include mathematics, physics, chemistry, neuroscience, software development tools, visualization, distributed computing, operating systems, and communication. Special emphasis is placed on the use of supercomputers.

Participants are expected to have knowledge and experience in the computer-oriented branches of their subjects. Students should already have completed their first degree but not yet have finished their master's course. Additionally, a letter of recommendation from a university lecturer or professor is required for application.

The programme will take place remotely over ten weeks from 1 August to 7 October 2022. Students are encouraged to apply for the programme online. The closing date is 30 April 2022. Further information can be found on the Internet at https://www.fz-juelich.de/ias/jsc/gsp/.

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OpenGPT-X: JUWELS Booster Trains Large European Language Models

Through the OpenGPT-X project, JSC is taking part in one of the most exciting European endeavours in the field of machine learning: the creation of a large-scale language model that speaks not only English but all major European languages. The project consortium of 10 organizations from academia, industry, and media has been granted funding of € 15 million by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) over three years. It seeks to bring large language models all the way from creation to application, using open-source technologies and publishing results as such. OpenGPT-X is a Gaia-X project, aiming to supply its developed services within the federated Gaia-X infrastructure.

Large language models have exciting potential. They are capable of processing and generating text with a quality that only two years ago would have been unthinkable. The OpenGPT-X partners would like to use these models for different real-world scenarios. The broadcaster WDR, for example, intends to make its library of audio documents ("Audiothek") more accessible by generating helpful summaries, and also plans to automatically generate personalized news articles. The company ControlExpert, meanwhile, aims to automatize claims processing for motor vehicle insurance.

JSC will mostly contribute to the project's foundation by training the basic language model. The sheer magnitude of this computationally very expensive task is impressive, even for the largest computers. OpenAI used a 10,000-GPU cluster for two entire weeks to train GPT-3, the model that acts as a blueprint for the project. Our colleagues at JSC will optimize the many facets of the training procedure to make the best use of the JUWELS Booster, currently one of the best-suited machines for such tasks in the world. Furthermore, the endeavour will afford us a chance to evaluate exciting, novel AI accelerator hardware.

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QSolid Project: Superconducting Quantum Computer Tightly Embedded in HPC System

The project "Quantum computer in the solid state" (QSolid) aims to create an all-German supply chain for quantum computing as a central building block of sustainable digital sovereignty for Germany. The goal is to develop a quantum computer demonstration system that is tightly embedded in an HPC system, based on cryogenic superconducting quantum processors integrated in a fully developed hardware infrastructure, right down to specific optimized firmware and software. In the first

phase of the project, high-quality components will be developed and the technology demonstrated in a medium-term device, a 10-qubit system with a ladder architecture. With the knowledge gained from this system, three processors with different performance and usage profiles will be developed, one of which will meet the requirement to outperform classic computers.

The Jülich Supercomputing Centre is contributing to two out of the project's eleven work packages. One of these focuses on the development of use cases for and the benchmarking of the quantum computer demonstrator, as well as the cross-platform benchmarking of the implementation of the use cases. The other work package addresses the provision of cloud access for the QSolid demonstrator, the HPC quantum computer integration, and scheduling and resource management.

QSolid is a project in the funding initiative "Quantum computer demonstrators", which is part of the BMBF framework programme "Quantum technologies – from basic research to market". QSolid is one of nine quantum computer demonstrator projects, most of which involve other qubit platforms such as trapped ions, trapped atoms, photons, and NV centres in diamond. QSolid will receive a total budget of € 76.3 million, of which 89.8 % is funded by the BMBF, over the next five years. The project started on 1 January 2022 and is coordinated by Prof. Frank Wilhelm-Mauch, who heads the Quantum Computing Analytics division at the Peter Grünberg Institute (PGI-12), one of nine participating subinstitutes at Forschungszentrum Jülich. Further information on the project is available on the BMBF's website.

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Estela Suarez Appointed Professor at the University of Bonn

Dr. Estela Suarez joined JSC in 2010 to work on technology exploration and exascale computing within JSC's Exascale Cluster Laboratory. In 2012, she took over the coordination of the EU-funded project DEEP (Dynamical Exascale Entry Platform). DEEP was the foundation stone of the *DEEP Projects* family, which has run for over ten years and has become one of the most successful HPC R&D endeavours in Europe.

Estela works on the continuous improvement of the Modular Supercomputing Architecture (MSA), one of the main results of the DEEP Projects and the central concept in JSC's strategy for exascale computing. Her work focuses on the integration of the latest hardware technologies and the introduction of more malleability and dynamicity in the use and operation of MSA systems, achieved via an adapted and enhanced software stack. Co-design plays a key role in her work, and involves bringing together application developers with hardware and software experts to shape future technologies according to user requirements and port a wider range of applications to the newest platforms. The broader scope of this work is reflected in the new JSC division *Novel System Architecture Design*, which she will lead once it is fully established.

In February 2022, Estela was appointed professor of High Performance Computing at the University of Bonn's Computer Science department, within the Faculty of Mathematics and Natural Sciences. She will retain her position at JSC according to the Jülich Model. The joint position will strengthen the existing collaborations with the University of Bonn, help to develop new cooperation opportunities, and attract students to work and perform HPC technology research at JSC.

Congratulations, Estela, and good luck with your new tasks.

Andreas Kleefeld Appointed Professor at University of Applied Sciences Aachen

In January 2022, Dr. Andreas Kleefeld was appointed professor for "Numerical and statistical methods for simulation and data science" at FH Aachen University of Applied Sciences, within the department of Medical Engineering and Technomathematics. He will retain his position at JSC in accordance with the Jülich Model. The joint position will strengthen the existing collaboration between Forschungszentrum Jülich and FH Aachen University of Applied Sciences and attract students to work and perform computational research. Furthermore, Andreas now coordinates JSC's teaching activities for the Applied Mathematics and Informatics (AMI) master's courses. In the upcoming summer semester, he will teach the master's course "Special numerical and statistical methods".

Andreas joined JSC's Mathematics and Education division in 2016 to work on the numerical solution of partial differential equations with a strong focus on boundary integral equations arising in acoustic, electromagnetic, and elastic scattering problems and related inverse problems. His current research topics include the numerical solution of non-linear eigenvalue problems arising in the theory of inverse scattering problems as well as of stochastic partial differential equations. He regularly teaches courses such as Linear Algebra 1 and 2 as well as Stochastics within the dual study program MaTSE/AMI at FH Aachen University of Applied Sciences at Campus Jülich. Moreover, he is the group leader of the Algorithm, Tools, and Methods Lab (ATML) entitled "Numerical and statistical methods".

JSC wishes Andreas all the best for his new position.

Martin Schultz Selected as Member of the Advisory Board of Destination Earth

Martin Schultz from JSC has been selected as a member of the strategic advisory board of Destination Earth. This high-profile initiative is part of the European Commission's Green Deal and Digital Strategy. Destination Earth aims to develop a high-precision digital model of the Earth to model, monitor, and simulate natural phenomena and related human activities. It will thereby reinforce Europe's industrial and technological capabilities in simulation, modelling, predictive data analytics, artificial intelligence (AI), and high-performance computing (HPC).