Pilot Lab Exascale Earth System Modelling

JSC is leading a new Helmholtz incubator project that aims to lay the foundation for new breakthroughs in earth system modelling (ESM) on future exascale computer architectures. There is increased societal demand for very high-resolution simulations of our environment as well as a better integration of the information value chain, from observations to coupled simulations and impact assessments. Recent technology trends, which lead to more heterogeneous HPC architectures and rapidly growing data volumes, require fundamentally new programming paradigms and call for a coherent strategy for creating next-generation earth system models based on close collaboration between domain scientists and computer experts. The new project is entitled Pilot Lab Exascale Earth System Modelling (PL-ExaESM) and contains five work packages, each partnering scientists from different research fields and Helmholtz centres. Within these packages, PL-ExaESM will explore new concepts to overcome scalability limits, increase flexibility in ESM workflows, overcome bandwidth limitations, optimize exascale HPC design, and improve ESM components through AI methods. The project will be led by PD Dr. Martin Schultz from the Earth System Data Exploration research group and managed by Dr. Catrin Meyer from the SimLab Climate Science. It will run from October 2019 until September 2021 and will become a Joint Lab ExaESM in the coming Helmholtz PoF IV period.

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‘Oumuamua – Outer Space’s Short Visit to Our Solar System

In 2017, ‘Oumuamua became the first recorded object from interstellar space to pass through our solar system. It immediately triggered considerable speculation due to its extraordinary characteristics: was it more like an asteroid or a comet? Some scientists even suggested it was a spaceship. In a study recently published in *Nature Astronomy* (DOI 10.1038/s41550-019-0816-x), an international team of scientists from Europe and the USA, including Susanne Pfalzner from JSC, analysed the collected data on ‘Oumuamua. What is particularly baffling is that while ‘Oumuamua appears to accelerate along its trajectory – which is typical of comets – the astronomers were unable to detect the gas emissions that are usually associated with this acceleration. The authors assume that the physical processes observed here are universal, but that they have simply not yet seen anything like ‘Oumuamua in our solar system. However, this study showed that ‘Oumuamua is of completely natural origin.

It is estimated that billions of trillions of objects like ‘Oumuamua are present in any cubic parsec (about 35 cubic light years) of the Milky Way. Susanne Pfalzner and Michele Bannister (Queens University Belfast, UK) showed in a second study (DOI 10.3847/2041-8213/ab0fa0) that the number of ‘Oumuamuas incorporated into a protoplanetary disk and participating in planet formation might be relatively high. One possible consequence of the abundance of these objects is that they might occasionally jump-start planet formation. Although much more work needs to be done, including many simulations, one thing is clear: the importance of interstellar objects in the planet formation process can no longer be ignored.

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HAICU Local at FZJ: JSC and INM-1 Cooperating on Machine and Deep Learning

With the Helmholtz Artificial Intelligence Cooperation Unit (HAICU), the Helmholtz Association aims to build a future-oriented network for basic and applied artificial intelligence (AI) research. As an interdisciplinary AI platform, HAICU will integrate the Helmholtz Association's outstanding science portfolio, excellent infrastructures, unique data sets, and extensive methodological competence in order to position the Helmholtz Association at the forefront of AI research. HAICU’s central unit is located at Helmholtz Zentrum München. Other Helmholtz centres have been selected as hosts for the five local HAICU units, so that together the units represent all six research fields of the Helmholtz Association.

To ensure mutual exchange and close alignment between research, development, and support activities in the field

of machine/deep learning (ML/DL), two dedicated teams will be deployed at JSC in the framework of HAICU Local at Forschungszentrum Jülich: the research-focused Cross-Sectional Team Deep Learning (CST-DL) and the newly established High-Level Support Team (HLST), focused on development and support. HLST will employ five researchers with experience in ML/DL research and software development. Jenia Jitsev and Morris Riedel will jointly lead the JSC section of HAICU Local, defining research topics and aligning support activities for long-term ML/DL research strategy at JSC. The research focus of CST-DL will be on enabling large-scale, continual, open-end learning on modular supercomputers, which includes integrated simulation-learning closed-loop systems with physics-informed constraints, methods for transferable, multi-task unsupervised and reinforcement learning, and distributed neural architecture search. CST-DL will work closely with HLST to make results and tools arising from research available to the broader scientific community and the general public. HLST will focus on development and research support in the fields of software engineering, data set creation and maintenance, and providing transparent open source implementations and documentation of outcomes from ML/DL related research. The Institute for Neuroscience and Medicine (INM-1) will also contribute to HAICU Local with a research group, thus continuing its long tradition of close cooperation with JSC.

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Memorandum of Understanding with Transmission System Operator TenneT

JSC and the main two sites of the transmission system operator TenneT – TenneT TSO GmbH in Bayreuth, Germany, and TenneT TSO B. V. in Arnhem, Netherlands – have signed a Memorandum of Understanding (MoU) to discuss and examine future projects in the context of electric power transmission systems for renewable energy production. The aim of this cooperation is the extension and optimization of current HPC strategies with regard to modular workflows, scheduling strategies, data handling capabilities, and the introduction of new, highly scalable algorithms and solvers for optimization problems. In addition, the cooperation plans to discuss new services such as the introduction of big data and machine learning algorithms for energy market analysis and power grid design, as well as to aid in decision-making.

This MoU builds on the fruitful HPC enabling process between JSC and TenneT which was finalized at the beginning of this year by experts in the Cross-Sectional Team Application Optimization at JSC. This allows responsibility for the newly co-designed system and regular software maintenance to be transferred to highly trained experts from TenneT and their IT systems operator.

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PRACE Summer of HPC Students at JSC

The Summer of HPC (SoHPC) programme, now in its seventh year, allows 25 university students from all scientific disciplines to spend eight weeks studying at a PRACE partner organization. In addition to allowing students to work on research projects in a multidisciplinary and international environment, the aim of the SoHPC programme is to promote and disseminate scientific culture among the upcoming generation of researchers, making sure that students participating in the project will be the computational scientists of tomorrow. Furthermore, through the participants' sharing of their experiences in blog posts and video presentations, the programme aims to ensure that the students themselves become ambassadors for supercomputing at their respective institutions.

This year, Andreas Nikolaidis (Cyprus) and Noé Brucy (France) joined JSC for the summer to gain first-hand experience in day-to-day research. After a training week for all 25 students in Italy hosted by CINECA, Andreas and Noé started work on their summer projects at JSC. Noé was supervised by Laura Morgenstern and worked on an optimized tasking framework for fast multipole methods on GPUs, while Andreas' project on lattice quantum chromodynamics was supervised by Stefan Krieg.

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JSC Collaborator Prof. Dietrich Stauffer Has Passed Away

It is with deep regret and sadness that JSC announces that its long-time friend and collaborator Dietrich Stauffer, Emeritus Professor at the University of Cologne, passed away on 6 August 2019. Prof. Stauffer was one of the most respected German researchers in statistical physics, shaping the evolving field of computational science and making seminal contributions to our understanding of critical phenomena. He later worked in the interdisciplinary field of econo- and sociophysics.

Dietrich Stauffer was the first head of the Many Particle Physics research group at the "Höchstleistungsrechenzentrum" (supercomputing centre) founded at Forschungszentrum Jülich in 1987, where he used supercomputers to set several world records in Ising model simulations. He was also actively involved in the conception of the international IUPAP Conference on Computational Physics, which was organized by JSC's predecessor institute and took place in Aachen in 2001. Those of you interested in Dietrich's work might like to take a look here: https://de.wikipedia.org/wiki/Dietrich_Stauffer.

The colleagues at JSC will remember him with great fondness.

Events

Introduction to GPU programming using OpenACC

Instructors: Dr. Andreas Herten, JSC; Jiri Kraus, NVIDIA
Date: 28-29 October 2019, 09:00-16:30
Venue: Jülich Supercomputing Centre, Computer Lab 1
http://www.fz-juelich.de/ias/jsc/2019/openacc

For further events, talks, and training courses, please visit: https://fz-juelich.de/ias/jsc/events