

UKAEA and Hartree Centre join forces to accelerate fusion energy research using advanced computing

The UK programme to deliver fusion energy – with its exciting potential to be a safe and sustainable part of the world's future energy supply – has been given a boost by a new collaboration between the Science and Technology Facilities Council (STFC) and the UK Atomic Energy Authority (UKAEA).

Under the collaboration, STFC and UKAEA will launch a Centre of Excellence in Extreme Scale Computing in Fusion, located at STFC's Hartree Centre, at its Daresbury Laboratory in the North West of England.

STFC's Hartree Centre is home to some of the most advanced computing, data and AI technologies in the UK, and UKAEA is a global leader in fusion energy science and technology. This collaboration will enable UKAEA to locate staff at the Hartree Centre and to grow sophisticated computing capabilities for the delivery of commercial fusion.

Fusion energy is highly attractive as part of future low-carbon energy supply, but there remain technical challenges to be overcome. These include producing and managing the 'plasma' – the ultra-hot gas where the fusion process happens – as well as challenges in materials and engineering design.

This collaboration will apply the latest computing systems and world-leading supercomputing and data science expertise at STFC to address some of these challenges, including understanding and modelling plasma, and producing the innovation required to develop so called 'Digital Twins' of future fusion power plants. These sophisticated models, running on supercomputers, are a key element for helping scientists and engineers to develop viable reactor technologies "in-silico" (in the virtual world) rather than via expensive, real world prototyping.

The converging landscape of supercomputing and Artificial Intelligence, combined with this unique collaboration, will accelerate the technology roadmap needed to make clean energy from fusion a reality and will establish the UK as an international leader in applying extreme scale computing to fusion engineering design.

About this collaboration

UKAEA and STFC, which is part of UK Research and Innovation (UKRI), are using complex modelling and simulation to progress understanding of fusion. This requires leading technical capabilities and access to the world's largest supercomputers, which STFC's Hartree Centre has already brought to bear across many other fields.

A major theme for the collaboration will be to exploit the predicted

confluence of High-Performance Computing and Artificial Intelligence at the 'exascale' – a turning point in computing where some have suggested that computers, capable of performing one quintillion mathematical operations per second (or an 'exaflop'), will have a power comparable with the human brain.

The establishment of the joint Centre of Excellence in Extreme Scale Computing in Fusion at Daresbury Laboratory will also give UKAEA a base of operations in the North of England, closer to its new Fusion Technology Facility in South Yorkshire.

Tim Bestwick, Chief Technology Officer at the UK Atomic Energy Authority, said:

The Hartree Centre and UKAEA each have extraordinary world-leading capabilities in their fields, so this unique relationship can really accelerate the vital mission of developing sustainable fusion energy – which we believe will play a key role in our low-carbon future.

Alison Kennedy, Director at STFC's Hartree Centre, said:

This new centre will allow fusion specialists to work shoulder to shoulder with our own scientists and engineers to co-design tools and methods for accelerating the UK fusion programme. Our relationship will further enhance our current collaborations with ATOS, Nvidia, IBM and other vendors.

We are as excited as UKAEA about the UK Government's prioritisation of fusion energy in their Ten Point Plan for a Green Industrial Revolution. Our own roadmap is strongly aligned with this document, and we believe strongly that Hartree Centre has unique, world-class expertise that will be essential for the timely delivery of commercial fusion energy.