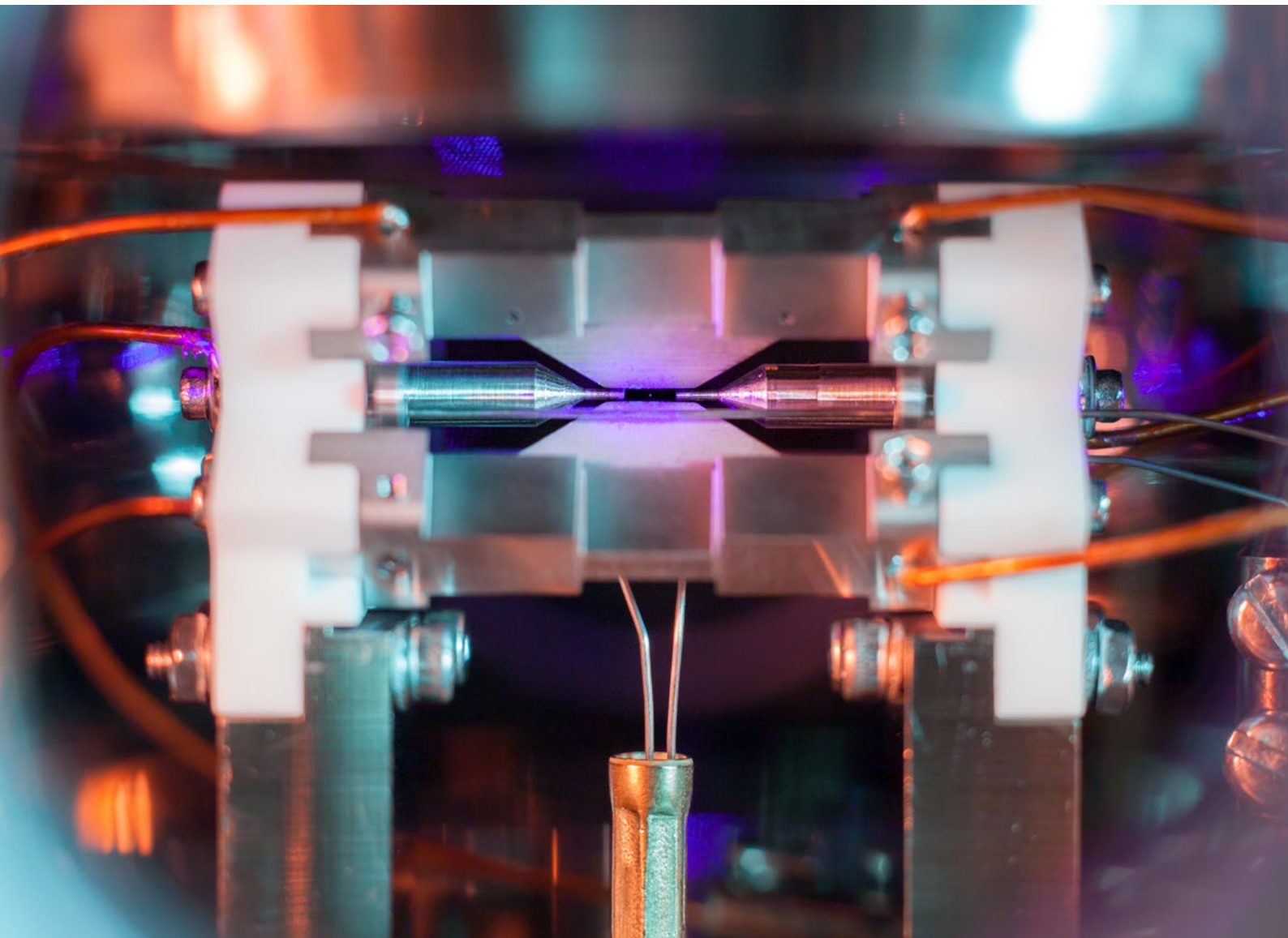


The Oxford Fusion Institute

Developing safe, clean, affordable power for the world



A single atom held in an ion trap © David Nadlinger



Overview

One of the most pressing challenges facing the world today – climate change – is intrinsically related to one of humanity’s most basic requirements: a reliable source of energy. Despite the increasing use and development of renewable fuel sources, and international efforts to lower carbon emissions, dependence on fossil fuels has remained unacceptably high. Now, however, the possibility of sourcing safe, clean, affordable power from nuclear fusion is tantalisingly close. While significant obstacles remain to be overcome before fusion powers homes and businesses, what was once purely hypothetical is now, as shown in the success of recent fusion experiments, becoming a reality.

The University of Oxford already has the academic expertise required to accelerate necessary advances in fusion energy. We are at the heart of an internationally leading fusion cluster in Oxfordshire, and have a particular strength in the development of methodologies – theoretical, mathematical and engineering – that can be applied across a range of technologies.

Building on our long-standing, symbiotic partnership with the world-leading United Kingdom Atomic Energy Agency (UKAEA), and working alongside UK and international partners, we are looking to establish the Oxford Fusion Institute (OFI). Our ambition is to facilitate and accelerate a scientific leap forward, which will enable the overcoming of key identifiable scientific and engineering problems that

currently limit our ability to design, build and operate a fusion power plant. At the same time, we will also be training international cohorts of future leaders in fusion research.

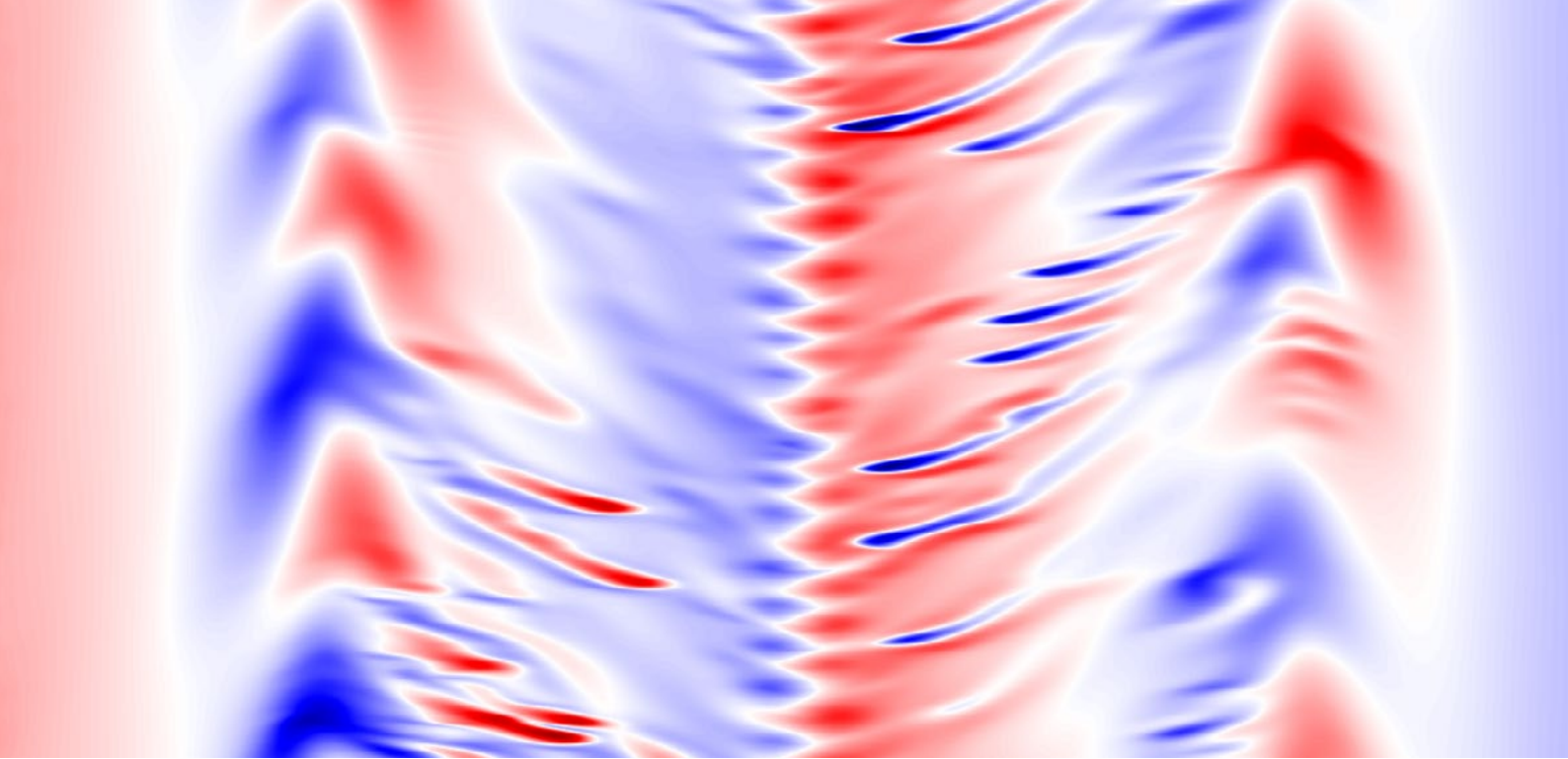
Fusion has the potential to be a major part of realising a net zero emissions energy portfolio that would transform the world... But, to make this happen, we must overcome substantial scientific and technical hurdles, which requires engaging the brightest minds on the planet. Our partnership with the University of Oxford is a unique and necessary way to get the best and brightest to bring their ingenuity to solving these problems, and this proposed radical expansion in activity would build the broadest span of fusion disciplines in any university.

Ian Chapman CEO of UKAEA

Key research areas

We recognise that our academic expertise focuses on particular areas of academic research. Building on these existing strengths, core activities at the OFI will focus on the following theoretical and practical research areas, which involve scientists working across the University’s Mathematical and Life Sciences Division:

- Controlling the plasma: how to confine plasma in a magnetic cage and keep it hot enough for sustained fusion burn



Plasma turbulence caused by temperature fluctuations © Plamen Ivanov

- Extracting the heat without damaging the components: delivering heat to a heat-exchanger for power generation whilst maintaining first-wall temperatures that guarantee commercially-acceptable component life
 - Materials and components in extreme conditions: developing a unique approach to the mitigation of life-limiting damage processes for structural and functional materials
 - Robotics and AI: researching key enabling technologies for robotic deployment in extreme environments, including nuclear robotics in fusion energy systems
 - Sensing in extreme environments: pioneering the functionalisation of synthetic diamond and sapphire that can withstand high radiation dose and extreme temperature
 - Harnessing the power of scientific computing, data science and mathematical modelling for fusion, maximising the impact of scientific computing, data science and mathematical modelling techniques across the whole range of scientific and engineering projects
- outstanding early and mid-career fusion-energy scientists and engineers, chosen because they can help solve the most important scientific and engineering problems
 - To ensure that this critical mass will be interdisciplinary by design, avoiding interfaces and gaps between islands of expertise. This will involve integrating faculty with no previous track record in fusion, but with important skills and expertise, into our fusion research programme
 - To attract and train over the first ten years at least 200 first-class fusion researchers in addition to our current cohorts
 - To expand our interactions with UKAEA and other partners to ensure tight focus on the most demanding fusion problems. Every individual OFI research project will be collaborative.

The Oxford Fusion Institute (OFI)

The key aims of the OFI are:

- To build the essential critical mass needed to address the crucial issues in fusion. The core of the OFI will be a close-knit team of the most

Conclusion

Our goal is simple: to lead the way in taking fusion energy out of the research centre and into the home, providing reliable, safe, affordable energy, and helping to end society's dependence on fossil fuels. We are committed to helping bring universal, affordable, green energy to the world.

