IMPERIAL

Improving Modelling Capability for Laser Non-Uniformity

UKAEA Fusion Internship Scheme

Project type: Computational
Open to: Undergraduates (students must be enrolled in a degree program during the placement, graduating 2027 or later)
Location: Blackett Laboratory, Imperial College London, SW7 2BW
Duration: 8 weeks (29/06-24/08, some flexibility)
Funding: £562.5/week
Application deadline: **Sunday 10th May 2026**
Contact: Dr Adam Dearling (a.dearling@imperial.ac.uk)

Project description

We are offering two 8-week summer internships exploring how high-power lasers can be used to make fusion energy a reality.

In inertial fusion experiments, powerful laser pulses compress a tiny fuel pellet to extreme temperatures and pressures. For this to work efficiently, the laser energy must strike the fuel as evenly as possible. However, tiny imperfections in laser intensity ("laser speckle") can seed instabilities that reduce fusion performance. Understanding and controlling these processes is a key scientific challenge for next-generation fusion systems.

What you'll work on

You will use advanced simulation tools developed at Imperial's Centre for Inertial Fusion Studies to model how high-power lasers interact with plasma, and compare your results with experimental data from the OMEGA Laser Facility.

Each intern will focus on one of two topics:

- **Laser imprint and instability**
  Investigating how small-scale variations in laser intensity ("speckle") seed hydrodynamic instabilities (e.g. Rayleigh–Taylor growth) during laser–target interactions.
- **Laser propagation in plasma**
  Studying how laser beams evolve as they travel through plasma, including effects such as self-focusing and filamentation under experimentally relevant conditions.

In both cases, you will:

- Perform targeted simulation studies
- Analyse and interpret experimental diagnostic data
- Compare simulations with experiment to assess model accuracy
- Identify key sensitivities and limitations in current modelling approaches

Who should apply

We welcome applications from undergraduate students in physics, mathematics, engineering, or a related with strong analytical and problem-solving skills, confidence in quantitative work, and some experience with programming (e.g. Python, MATLAB, or similar)

To apply, students should complete the following form: https://forms.gle/yiziRjHzV3FV5dee7

Prior experience in plasma physics or fusion is not required. We are particularly interested in candidates who can clearly explain their motivation for the project and demonstrate how they have applied technical or computational skills in practice. We recognise that students have had different access to opportunities and will consider potential as well as prior experience.

Further reading

Craxton, R.S. et al., "Direct-drive inertial confinement fusion: A review," Phys. Plasmas 22, 110501 (2015)

- sections VI, VII and IX will be more relevant to the project on imprint and instability
- sections X and XI are closer to the project on laser propagation