Summer 2024 – Undergraduate Research Placement in Plasma Physics

UNIVERSITY of York

AMPLIFI Prosperity Partnership

Understanding the X-ray emission of energetic electrons generated in inertial fusion experiments.	
Project type: **Simulation and comparison to data (computational)**	Open to: **Undergraduates (years 2 & 3 preferred*)**
Location: **York Plasma Institute, University of York, York YO10 5DD**	
Duration: **8-10 weeks (June-Sept period, dates flexible)**	Bursary: **approx. £400/week (TBC)** funded by EPSRC AMPLIFI Prosperity Partnership with First Light Fusion
Application deadline: **Weds 26th April 2024, 4 pm**	Contact: **Nigel Woolsey (nigel.woolsey@york.ac.uk)**

*Students must be enrolled in a degree program at the time of the placement (i.e. graduating 2025 or later). 4th year students accepted for 5-year degree programs.

Project description

Pursuing fusion as a ‘clean’ energy resource is an important and global endeavour. There are several approaches to this and one approach is inertial fusion energy which typically uses lasers to compress and heat deuterium-tritium fuel in an implosion. The National Ignition Facility (NIF) in California USA on 5th December 2022 demonstrated this works, achieving the first laboratory measurement of energy gain exceeding unity. There remain many basic physics questions and challenges that are not understood. The need to understand these challenges is fundamentally important and this requires the application of many measurement techniques across a broad range of experiments on many laser facilities across the world. In inertial fusion it is important to understand the role of energetic electrons. Energetic electrons generated by instabilities as a laser interacts with a plasma can preheat the fuel and significantly decrease the efficiency of experiment.

A sub-MeV hard x-ray spectrometer – called the sMBC – is used to record the electron spectrum and the conversion of laser energy into these electrons in a laser fusion scheme known as shock-ignition. You will use Monte Carlo software to simulate the Bremsstrahlung radiation spectrum produced by energetic electrons of different energy and temperatures as they interact with different target types. By comparing the simulated signals with the results from an experiment, you can help us to understand the properties of the electrons generated as the laser and target configuration of an experiment is changed. We are therefore searching for a summer intern interested in fusion, laser-plasma physics and willing to learn about energetic electrons in inertial fusion! Applications are welcomed from undergraduate students for the summer 2024.

Further reading

https://www.amplifi-partnership.org.uk/ and https://www.york.ac.uk/physics-engineering-technology/ypi/
https://lasers.llnl.gov/news/age-of-ignition
Scott, et al., hock Ignition Laser-Plasma Interactions in Ignition-Scale Plasmas, https://doi.org/10.1103/PhysRevLett.127.065001