Summer 2024 – Undergraduate Research Placement in Plasma Physics

Proton radiograph; visualising magnetic and electric fields in laser produced plasmas.	
Project type: **Data analysis (Experimental)**	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, 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 approach 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 plasma physics it is important (as well as challenging) to understand the role of electric and magnetic fields. Proton radiography is a diagnostic used to capture a path integrated image of the electric and magnetic fields by firing a beam of protons through a plasma.

Radiochromic film (RCF) records an image by darkening in response to the energy deposited by the protons. The RCF is typically stacked in multiple layers with filters placed between the layers forming a spectrometer; the lower energy protons are recorded earlier in the stack. An analysis code, written in Python, extracts the dose spectrum from images of the individual RCF layers. Currently this code requires significant manual pre-processing of the RCF images. We are therefore searching for a summer intern interested in fusion, laser-plasma physics and Python to take on this exciting opportunity to learn about proton imaging and automate the pre-processing and analysis stages of the code; all whilst gaining experience with real data, image processing techniques and automation. Applications are welcomed from undergraduate students for the summer of 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
Arran, et al., Proton radiography in background magnetic fields, https://doi.org/10.1063/5.0054172