Summer 2024 – Undergraduate Research Placement in Plasma Physics

MAGPIE
Pulsed Power
Generator

Experimental placement in X-ray High Energy Density Physics @ MAGPIE and Extreme Physics Laboratory, Imperial College London

Project type: **Experimental (lab based)**	Open to: **Undergraduates (years 2 & 3 preferred*)**
Location: **Blackett Laboratory, Imperial College London, SW7 2BW**	
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: **Wed 21th Feb 2024, 5 pm**	Contact: **Dr Jergus Strucka** (js7815@ic.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

High powered laser sources and pulsed power generators allow the exploration of matter and radiation under conditions comparable to the most extreme conditions in the universe. This has lead to a new and exciting field of research: High Energy Density Physics (HEDP), where physicists produce plasmas at energy densities >100 KJ/cm^3 and study their interactions, often in the presence of strong electromagnetic fields and intense X-ray-radiation.

At the MAGPIE generator at Imperial College London, we employ high-voltage electrical discharges to produce supersonic flows of ablated plasma from the surface of thin wires or foils. Our house sized generator, located in the basement of the Blackett Laboratory, delivers a pulsed electrical current of 1.4 MA in a timescale of 250 ns. Plasma flows launched during these experiments form centimeter scale structures, with strong embedded magnetic fields (~1-10 T) and velocities of ~100 km/s. Control of the material and geometry of these plasma flows allows us to study fundamental plasma processes such as magnetohydrodynamic shocks, instabilities and magnetic reconnection, however, these experimental studies require an ever improving set of diagnostic techniques.

In the summer 2024, we are looking for an undergraduate student to work as part of the HEDP team. You will be involved in a project to develop an X-pinch X-ray imager for the MAGPIE facility. The X-ray source will be driven by a novel portable pulsed-power generator – the Dry Pinch I, which will be interfaced to the experimental chamber of MAGPIE during the internship. The work will involve assembly of the system, testing the timing accuracy of the two machines, understanding the X-ray parameters and geometry achievable within the chamber, as well as development of technical solutions to improve the diagnostic. Finally, we expect to perform X-ray radiography measurements of radiatively ablated plasmas. During the summer, you will also likely experience many of the other commonly used diagnostics including interferometry, shadowgraphy, Thomson scattering, spectroscopy, self-emission imaging and magnetic field measurements (inductive probes, Faraday rotation).

Prior experience in plasma physics is not necessary to apply, but applicants should demonstrate experimental & technical experience, be good at working as part of a large team, and proficient in undergraduate level laboratory and data analysis techniques. To apply please send your CV and an accompanying cover letter.

Further reading

https://www.imperial.ac.uk/plasma-physics/magpie/
http://www.imperial.ac.uk/urop

[1] J. Strucka *et al.*, Matter and Radiation at Extremes (2022)
[2] S.V. Lebedev, A. Frank and D.D. Ryutov, Reviews of Modern Physics (2019)