Summer 2024 – Undergraduate Research Placement in Plasma Physics

Imperial College London

MAGPIE
Pulsed Power Generator

AMPLIFI
Prosperity Partnership

Experimental placement in Magnetized High Energy Density Physics

@ MAGPIE Pulsed Power 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 14th Feb 2024, 5 pm**	Contact: **Dr Lee Suttle** (ls910@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

Advances in the capabilities of high powered laser sources and pulsed power generators allow the exploration of matter and radiation under extreme conditions. This has lead to a new and exciting field of research: High Energy Density Physics (HEDP), where physicists are able to produce highly-ionized plasmas at energy densities in excess of 100 KJ/cm^3 and study their interactions, often in the presence of strong electromagnetic fields and intense Xray-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 metallic 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 from this driver 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, as well as creating intense X-ray sources (X-pinches and Z-pinches), and supporting research in applications such as inertial confinement fusion and laboratory astrophysics.

For summer 2024 we are looking for undergraduate students to work as part of the MAGPIE team. You will be involved in a range of HEDP experiments, including studies of radiatively ablated plasmas, magnetized collimation of supersonic jets and plasma-interface instabilities. In doing so you will gain experience in the setup and operation of many high-temperature plasma diagnostic techniques including: pulsed laser probing (interferometry, shadowgraphy, Thomson scattering), spectroscopy (X-ray, optical, XUV), self-emission imaging and magnetic field measurements (inductive probes, Faraday rotation). The studentship may also include the design and development of technical infrastructure and methods related to the operation of the pulsed-power facility. Prior experience in plasma physics is not necessary, 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] L.G. Suttle *et al.*, Plasma Physics and Controlled Fusion (2020)
[2] S.V. Lebedev, A. Frank and D.D. Ryutov, Reviews of Modern Physics (2019)
[3] L.G. Suttle *et al.*, Review of Scientific Instruments (2021)
[4] D.R. Russell *et al.*, Physical Review Letters (2022)