Summer 2023 – Undergraduate Research Placement in Plasma Physics

Imperial College London

MAGPIE
Pulsed Power Generator

Experimental placement in Magnetized High Energy Density Physics

@ MAGPIE Pulsed Power Generator, Imperial College London

Project type: **Experimental (lab based)**	Location: **Blackett Laboratory, Imperial College London, SW7 2BW**
Open to: **Undergraduates (years 2 & 3 preferred)**	Positions available: **1**
Duration: **8-10 weeks (June-Sept period, dates flexible)**	Bursary: **approx. £330/week (TBC)**
Application deadline: **Mon 20th Feb 2023, 5pm**	Contact: **Dr Lee Suttle** (ls910@ic.ac.uk)

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 2023 we are looking for an undergraduate student to work as part of the MAGPIE team. You will be involved in a wide range of HEDP experiments, including studies of rotational plasma instabilities, radiatively driven plasmas and magnetized turbulence. 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). Applicants should be practically minded, keen to experiment, good at working as part of a large team and patient with the inevitable delays associated with cutting-edge laboratory research. Prior experience in plasma physics is not necessary, but applicants should demonstrate proficiency at 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)