

# **IOP** | Institute of Physics **Plasma Physics Group**

## **UK Plasma Physics News – Summer 2015**

Welcome to the UK IOP Plasma Physics Group (PPG) e-newsletter. If you have items for inclusion in future newsletters, please send these to [p.browning@manchester.ac.uk](mailto:p.browning@manchester.ac.uk) – meeting announcements, research achievements, new appointments, facilities, projects, buildings etc.

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### **COMMITTEE NEWS**

The Annual General Meeting was held in Milton Keynes at the Spring conference. We are very grateful to retiring committee members (Mark Bowden, Roddy Vann, Simon Vickers) for their valuable contributions to the work of the committee. Especial thanks are due to our outgoing Treasurer, Alex Robinson, who has kept our financial affairs in excellent order and also contributed to the Group's activities in many other ways. Ceri Brenner (STFC) – previously an ordinary committee member - has been elected as our new Treasurer. We are very grateful to Ceri for taking on this role. We also welcome new committee members: Josie Coltman (AWE), Ben Dudson (York), Bogdan Hnat (Warwick) and Paul Maguire (Ulster).

### **RECENT/CURRENT MEETINGS**

#### **42<sup>nd</sup> Spring IOP Plasma Physics Conference**

Our flagship annual plasma physics meeting was held at Kents Hill Park Training & Conference Centre, Milton Keynes, 30<sup>th</sup> March – 2<sup>nd</sup> April 2015, hosted by Nick Braithwaite of The Open University. A set of excellent invited presentations, contributed talks, and posters, covered a very wide range of topics in plasma physics, and there were many interesting discussions. An invited talk was presented by the Culham Thesis Prize winner (see below), and an invited lecture on “Cosmic Ray Acceleration” by Tony Bell (Oxford) was specifically sponsored by the IoP Computational Physics group.

The conference featured a special afternoon associated with the International Year of Light: including a public engagement evening with exhibits by Ceravision, the OU's SEPnet outreach and the OU's Rosetta mission team and short presentations by John Stocks (Ceravision: *Non Visual Impacts of Light*), Lucia Marchetti (OU: *Cosmic light: the story of everything*) and Calum MacCormick (OU: *How to slow atoms with light and how to slow light with atoms*). Delegates enjoyed a fascinating trip to the National Museum of Computing at Bletchley Park.

The meeting was generously supported by CCFE, STFC, AWE, EPS and IoP Computational Physics group. The public engagement evening was kindly supported by Hiden Analytical, Ceravision, Oclaro and the IoP Plasma and Ion Surface Interactions group.

### **UK ELI-NP Meeting in York**

A daylong meeting of plasma and nuclear physicists was held in York on Friday 3rd July 2015 to discuss the UK contribution to the Extreme Light Infrastructure (ELI-NP). The conference was organised by Christopher Murphy (plasma) and David Jenkins (nuclear) from the University of York and supported jointly by the IOP Plasma and IOP Nuclear Groups as well as STFC-Central Laser Facility. The purpose of the meeting was to encourage engagement between the two communities with the eventual aim to generate UK-led collaborative experiments on the Extreme Light Infrastructure – Nuclear Physics (ELI-NP) facility in Romania.

A series of 11 talks were given covering diverse science topics like laser-plasma accelerators and gamma rays for nuclear physics as well as some technical talks about the ELI-NP facility. The talks were presented by internationally renowned speakers and posters about the technical capabilities of ELI-NP gave an opportunity for more specific discussions during the coffee breaks. Seven UK institutions were represented amongst the thirty-five attendees and several opportunities for funding and experimental collaborations have been identified. It is hoped that a follow-up meeting will be held next year to help build on the successes of this meeting.



### **IPELS**

IPELS15 (partially sponsored by our group) is being held at the Atholl Palace Hotel in Pitlochry August 23<sup>rd</sup> – 28<sup>th</sup>. This is an international meeting bringing laboratory plasma physicists, space plasma physicists and astrophysicists to discuss topics of common interest.

### **FORTHCOMING MEETINGS**

**43<sup>rd</sup> IOP Plasma Physics Conference: 23<sup>rd</sup> – 26<sup>th</sup> May 2016, Isle of Skye**

**<http://plasma16.iopconfs.org>**

We are very pleased to announce that our annual conference in 2016 will be held at Sabhal Mor Ostaig in the beautiful Isle of Skye, hosted by Declan Diver (University of Glasgow).

As ever, this conference covers all aspects of plasma physics, including Magnetic and Inertial confinement Fusion, Astrophysical and Space Plasmas, Low Density and Technological/Industrial Plasmas, High Energy Density and Laser Plasmas, Dusty and Complex plasmas, Plasma Surface interactions, and Plasma Applications including Medical applications and Plasma Diagnostics.

This is a very attractive venue which should foster discussions and interactions between delegates (as well as presenting wonderful opportunities for holidays post- or pre- conference!). The costs of the conference are likely to be very reasonable, which should offset (possibly) higher than usual travel costs. Put the dates in your diaries now!

**Invited speaker nominations** We encourage the community to suggest names for invited speakers. Please send these to our Secretary [christopher.ham@ccfe.ac.uk](mailto:christopher.ham@ccfe.ac.uk) by September 18<sup>th</sup> 2015.



### **Solar-Tokamak Workshop 2 - "Beyond Single Fluid"**

This has been CANCELLED but it is hoped to re-arrange a workshop to encourage university involvement in CCFE tokamak edge physics programme at a future date.

### **BOUT++ workshop; September 14<sup>th</sup> – 16<sup>th</sup> 2015 , University of York**

The BOUT++ code is a flexible tool for the simulation of plasma fluid equations, primarily focussed on tokamak edge simulations. This workshop will combine hands-on training in using BOUT++ with lectures on tokamak edge physics, numerical simulation techniques, and related topics.

All those with an interest in using BOUT++ or in tokamak edge simulation, are invited to attend.

There is no fee. If you are interested in attending, please contact Ben Dudson

[benjamin.dudson@york.ac.uk](mailto:benjamin.dudson@york.ac.uk) by August 31<sup>st</sup>. More details can be found at

<http://boutproject.github.io/workshop2015.html>.

### **13<sup>th</sup> Technological Plasma Workshop: 14<sup>th</sup> -15<sup>th</sup> October 2015**

The 13th Technological Plasma Workshop 2015 will be taking place on 14<sup>th</sup> – 15<sup>th</sup> October 2015 at the Ricoh Arena, Coventry, CV6 6GE, UK.

The Technological Plasma Workshop (TPW) is principally a UK-based international forum in science and technology of plasmas and gas discharges. Delegates from all countries are very welcome to

participate in this workshop. TPW 2015 aims to foster academic-industry collaboration and to engage young plasma scientists with a scientific programme anchored by leading plasma scientists. The workshop will comprise of invited talks, contributed oral presentations and a poster session. It is free to register and workshop details can be found at:

[www.tpw-uk.org](http://www.tpw-uk.org)

**Registration deadline:** 5pm, 7<sup>th</sup> October 2015

**Abstract submission deadline:** 5pm, 9<sup>th</sup> October 2015

### **Workshop on “Microwaves in plasmas & beams”**

17<sup>th</sup> – 18<sup>th</sup> December 2015 (lunchtime-to-lunchtime)

School of Natural Sciences, University of York

Organisers: Roddy Vann (York) & Adrian Cross (Strathclyde)

Topics relevant to the workshop include all aspects of microwave physics relevant to plasmas & beams. There is no registration fee. If you would like to attend, please email Roddy Vann

[roddy.vann@york.ac.uk](mailto:roddy.vann@york.ac.uk) for more details.

*The PPG Committee is always keen to receive offers from members to organise one day meetings, especially on topics which bring together different areas of research. We have a small amount of funding available to support such meetings, and can assist with publicity, finding speakers etc.*

### **CULHAM THESIS PRIZE**

We congratulate David Maclellan from Strathclyde, the winner of the 2014 Culham Thesis Prize for his thesis "Effects of Electrical Resistivity on Fast Electron Transport in Relativistic Laser-Solid Interactions". David gave an excellent presentation on this work at the Spring Conference in Milton Keynes. We are very grateful to CCFE for sponsoring this award, and we also thank the judges for their hard work.

### **RUTHERFORD PLASMA PHYSICS COMMUNICATION PRIZE**

The Rutherford Plasma Physics Communication prize, generously sponsored by STFC, is awarded for an excellent achievement in outreach – this could be a podcast, video, lecture, public talk, website, essay, blog, article etc. The Committee are recommending that in future all plasma physicists within our group should be eligible to apply (rather than just PhD students, as previously). More information will be announced in the Autumn. Meanwhile, you are all encouraged to engage in excellent outreach projects!

### **NEWS FROM CULHAM CENTRE FOR FUSION ENERGY**

#### **52<sup>nd</sup> Culham Plasma Physics Summer School**

The Culham Summer School ran again this year from 13<sup>th</sup> July to 24<sup>th</sup> July. 44 students from around the world came to Culham to learn about plasma physics from basic theory to applications including magnetic confinement fusion, inertial confinement fusion, laser wakefield acceleration, low temperature plasmas and solar and astrophysical plasmas. The UK plasma physics community provide most of the Summer School lecturers and the students rated their efforts very highly. The students also had tours of the MAST and JET experiments at Culham and the Central Laser Facility at RAL.

#### **MAST-Upgrade News**

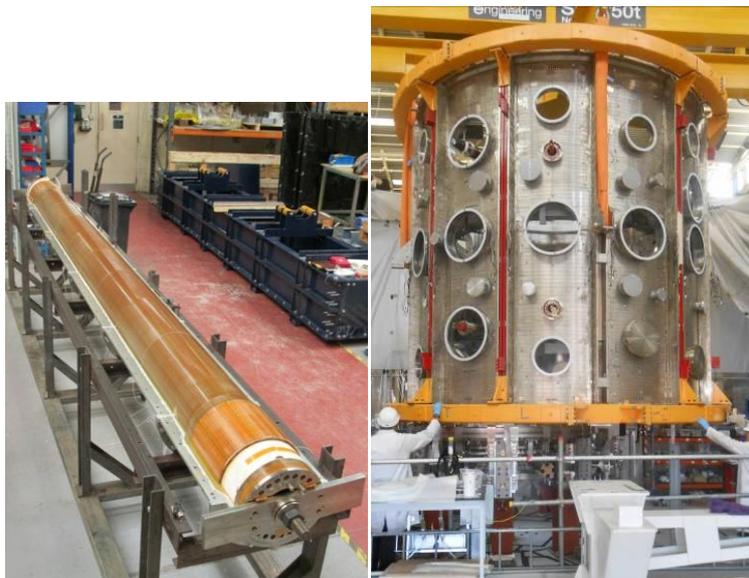
Several major milestones have been achieved over the last few months that ensure the project remains on track with respect to the schedule with a target for pump down of October 2016.

These milestones represented some of the biggest outstanding technical risks facing the project.

**The TF centre rod vacuum impregnation:** This has been completed and all indications are that this has been successful (photo). This was one of the biggest risks still facing the project. Final electrical tests will confirm the positive test results gathered so far (including visual and dimensional inspections as well as electrical testing at an intermediate voltage).

**First assembly phase of the outer cylinder:** The completion of the first assembly phase of the outer cylinder and the divertor nose lower cassette, with the result that the project is on track to have the lower cassette fully installed into the vacuum vessel soon. This will allow the next phase of construction to begin including the installation of key diagnostics and all graphite tiles that line the lower structures in the vessel.

**Progress on the power supplies infrastructure:** This also remains on track, with installation and cabling completed for the majority of the pulsed power supplies in the new MAST-U power supplies area and local load commissioning of the new Toroidal Field Power Supply.



### **MAST-U Collaboration Opportunities**

MAST Upgrade is due to begin commissioning in October 2016, with the first physics exploitation campaign in 2017. The MAST-U machine will be an exciting new device for the UK to use. The plasma physics programme within CCFE has been reoriented to look at specific areas; in particular exhaust physics and integrated scenarios. However, the machine is capable of being used to study a broad range of tokamak and plasma physics topics.

There are also significant opportunities for funding and support from EUROfusion for participation in the EU magnetically confined fusion research.

If you are interested in finding out more about being involved in MAST-U research and possible EU financial support for this work please contact Ian Chapman, Head of Tokamak Science research at CCFE [ian.chapman@ccfe.ac.uk](mailto:ian.chapman@ccfe.ac.uk). The MAST Upgrade Research Plan can be found at:

[www.ccfе.ac.uk/assets/documents/other/MAST-U\\_RP\\_v3.pdf](http://www.ccfе.ac.uk/assets/documents/other/MAST-U_RP_v3.pdf)

## NEWS FROM AWE

### The Orion laser's academic access programme gets off to a great start

[www.awe.co.uk](http://www.awe.co.uk)

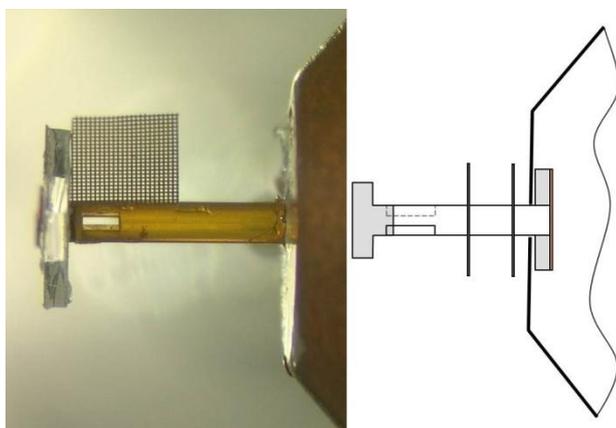
The world-leading Orion laser located at AWE Aldermaston is one of the biggest capital science projects in the UK in the last 25 years. Orion is a high-energy-density-physics experimental facility. It enables AWE scientists and physicists to improve their understanding of nuclear warhead science, using a model-based approach, in the absence of live testing. This is essential to the safety, reliability and performance of the warhead as part of our commitment to the UK's nuclear deterrent.

Orion is a national asset and although its main purpose is to support the deterrent programme, the MOD has made some of Orion's time available (up to 15% per year) to external users for cutting-edge collaborative academic research. Following the first two calls for proposals, four academic experiments were scheduled on Orion; two for the University of Oxford, one for the University of York and the fourth for Imperial College London.

The first international experimental team was led by University of Oxford academic, Professor Gianluca Gregori. The experiment studied supersonic plasma interactions such as those found between binary stars. The academic team found the 'Orion' experience a great success. Gianluca said: "Given that this was the first academic experiment, it was normal to expect that things would not always go as expected. Instead, all went as planned and we got fantastic results on the first day of the experiment. This is something that rarely happens, even on laser facilities that have had a strong academic programme for many years. I would be delighted to see the Orion laser grow as a point of reference for laboratory astrophysics experiments in the UK. We would definitely hope to use the Orion laser again."

The second Orion academic campaign, led by Oxford's Dr Andy Higginbotham (now at the University of York), used x-ray diffraction techniques to study matter at extreme pressures. Following the experiment Andy said: "The quality of the data we obtained at Orion is unprecedented. This has allowed us to gain deep insight into the response of silicon to rapid compression; a topic which has puzzled the scientific community for around two decades."

Both experiments are now at a point where they are poised to submit their work to scientific journals. Orion is currently in the middle of conducting the next series of academic campaigns. Professor Nigel Woolsey, from the University of York, is working on magnetic reconnection and its relevance to Inertial Confinement Fusion. Dr Francisco Suzuki-Vidal, from Imperial College London, is studying the formation of radiative shocks and their counter-streaming interaction, which is pertinent to astrophysics phenomena. Early indications are that these campaigns are also likely to be very successful for both the academics and AWE.



*Sketch and photo of the targets used for Gianluca's academic astrophysics campaign produced by Chris Spindloe, Rutherford Appleton Laboratory (see High Power Laser Science and Engineering, Vol. 3, e8 (2015))*

**Orion fascinating facts:**

- The Orion laser facility is housed in a building the size of a football stadium
- Orion allows scientists to study conditions similar to those in stars and inside giant planets like Jupiter
- The energy created by Orion is directed at a tiny sub-millimetre scale target, components of which are typically a fraction of the width of a human hair
- Orion can recreate temperatures close to those in the centre of the Sun – up to 10 million Kelvin
- Orion conducts experiments by researchers from all over the world