

## **IUPAP C16 report 2013-2014**

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### **I. IUPAP C16 Sponsored/Endorsed Conferences**

The 17<sup>th</sup> International Congress on Plasma Physics (ICPP), Lisbon, Portugal. 15<sup>th</sup>-19<sup>th</sup> September, 2014. The Chair of the meeting was Professor Tito Mendonca of the Instituto Superior Tecnico.

This is a category A conference the scope of which is to discuss recent progress and to establish a view on future plasma physics topics. The conference covers a wide range of topics in plasma science including fundamental plasma physics, fusion plasmas, plasma accelerators, astrophysical plasmas and plasma applications. This is a bi-annual meeting that brings together scientists from around the world to present the latest scientific results. The subject matter of the meeting is mostly in the area of high temperature plasmas.

One of the important aspects of this meeting is that it covers a broad area of research within one meeting. The topics range from quantum plasmas to the very large astrophysical plasmas as well as bringing the normal plasma activities such as fusion and plasma accelerators together. Quantum plasmas are found in highly compressed matter such as the interior of stars where the equation of state determined by quantum is important in understanding formation processes. In astrophysics plasmas surrounding black holes or radio jets are increasingly being studied. The sister meeting is the International Conference on the Phenomenon on Ionised Gases held on alternate years. This conference concentrates on low temperature plasmas with strong industrial content such as plasmas used in lighting, medical applications, plasma processing of materials and more recently plasmas processes are being investigated as a possible carbon dioxide reduction method in the atmosphere.

The 7<sup>th</sup> international conference on the Physics of Dusty Plasmas, New Delhi, India. 3<sup>rd</sup>-7<sup>th</sup> march 2014. The Chair of the meeting was Professor Khare Avinash, University of Delhi.

This is a category B international meeting and takes place every three years. The topic is the physics of charged macro particle in a plasma environment. It has applications in both laboratory space and astrophysical plasmas.

### **II. C16 Young Scientist prize in Plasma Physics**

**PURPOSE:** The IUPAP C16 Young Scientist Prize recognises exceptional achievement in the study of plasma physics by a scientist at a relatively junior stage of their career. The recipient is expected to have displayed significant scientific ability in an area of plasma physics covered within the topics of ICPP.

The 2014 prize winner was Wei Lu of the Department of Engineering Physics, Tsinghua University, Beijing.

The citation reads:

For original contributions to high intensity laser and beam plasma interactions including a theory for nonlinear plasma wakefields and widely used scaling laws for Laser Wakefield Acceleration in the nonlinear regime.

He completed a PhD on plasma accelerators at UCLA. His research demonstrates the feasibility of plasma accelerators that may one day replace conventional accelerators in the quest for ever higher energy machines. Plasma accelerator research is a growth area in plasma physics which has seen impressive results in the last few years.

The prize medal and certificate were presented at the ICPP meeting in Lisbon where Wei Lu presented the IUPAP Prize talk.

### III. IUPAP C16 committee meetings.

Held on September 19<sup>th</sup> 2014 at the 17<sup>th</sup> International Congress on Plasma Physics (ICPP) Lisbon, Portugal. The committee endorsed the next International Conference on the Phenomenon in Ionised Gases (ICPIG) to be held in Hungary 2015 as well as the Laser and Plasma Accelerator Workshop, May 2015 in Quadaloupe. As well as endorsing the future meetings the committee discussed the change-over in December to the new committee and suggested that old members should meet their new country representative to pass on ideas and information about IUPAP.

November 26<sup>th</sup> 2014, at the APS Division of Plasma Physics , New Orleans.

### IV. Outreach.

Outreach is also a very important activity of IUPAP by promoting plasma physics. It is widely recognised that one of the important topics in plasma physics is net energy gain from fusion. Fusion has been demonstrated for some time but the elusive energy gain goal still remains elusive. At present two main approaches are being pursued namely magnetically confined fusion using machines such as ITER that is being constructed in Cadarache in southern France and inertial confinement fusion such as the NIF laser facility. In the NIF project although no net energy gain has been achieved so far, fusion alpha particles are responsible for heating the deuterium tritium plasma, this is a major result in the pursuit of harnessing fusion energy. Plasma accelerators are also demonstrating real promise in producing useful beams of particles. These are used in experiments to produce x-rays and gamma rays for applications in material and medical sciences. Plasma accelerators are seen as possible replacements for conventional accelerators in achieving the energy frontier, they have accelerating gradients 1000 times larger than conventional accelerators making the machines more compact for the same energy gain. Laboratory astrophysics is also beginning to make important tests of astrophysical problems such as the origin of the primordial magnetic field and intense radio emission mechanisms and the physics of black hole accretion discs. One aspect that has made a difference to the subject is the very large 3 dimensional simulations in particular gyro kinetic and full particle in cell codes that are available. Plasmas have made an incredible difference in the modern world by being used in the manufacture of new materials and silicon chip manufacture.

