Winter-school on industrial and fusion plasmas
July 7-9, 2010, Research School of Physics and Engineering, ANU, Canberra.

Lectures: Seminar room, Oliphant Building.

This mini-school spans fundamental plasma processes, plasma formation and heating of plasma suited for processing and propulsion through to the burning plasma physics of fusion power.

It is an exciting time for ANU plasma physics research, with growth in plasma theory, modelling, and experimental research pursuits, and $7m investment into the Australian Plasma Fusion Research Facility. Participation in the mini-school provides exposure to an excellent range of research opportunities across the plasma science discipline, including plasma processing, plasma propulsion, and fusion energy projects. The skills developed at the mini-school are directly relevant to burning plasma physics for ITER, the next step fusion energy experiment - also the world's largest science experiment.

Up to 10 AINSE student bursaries are supported to attend the Mini-school. Student bursaries, which will support travel & accommodation, will be awarded by order of merit and application. Applications are available at http://prl.anu.edu.au/winterschool2010 and should be sent to Dr Matthew Hole at matthew.hole@anu.edu.au. Applications are due June 15.

The minischool comprises sets of Lectures on three (see below for more details):

Series A . "Fundamental plasma processes in low temperature plasmas: Discharges, heating, diagnostics and applications", Dr Cormac Corr, Research Fellow, Research School of Physics and Engineering, ANU.

Series B: “Electrodynamics for plasma physics”, Dr Matthew Hole, ARC Future Fellow, Research School of Physics and Engineering, ANU.

Series C: "Toroidal Magnetic confinement: equilibrium and stability", Dr Sergei Sharapov, Culham Centre for Fusion Energy (UK)

Lectures will be complemented by a range of stimulating experiments and tutorials. We will also arrange laboratory tours of major research facilities at ANU physics. A school dinner will be held on the second day.

Further information (check June 15 for program, travel,& accommodation updates)


http://www.ainse.edu.au/fusion/events.html (mirror)
Further lecture details...

Series A. "Fundamental plasma processes in low temperature plasmas: Discharges, heating, diagnostics and applications", Dr Cormac Corr, Research Fellow, Research School of Physics and Engineering, ANU.

The unique physical and chemical environment created in plasma is widely exploited in industry such as in the microelectronics industry to create the submicron-sized architectures on microelectronic devices. Their industrial applications have rapidly expanded into areas as diverse as polymer processing, ion propulsion and biomedicine. This plasma physics course is designed to provide students with an understanding of the principles of plasma physics through research-led teaching.

Following an introduction to basic plasma physics and gas discharges, the course will introduce students to various types of laboratory plasmas that are routinely used in nanotechnology, materials processing and ion propulsion. The course outline is as follows:

- Introduction to plasma physics and gas discharges
- Plasma confinement, sheaths and discharge equilibrium
- Radiofrequency plasma discharges
- Plasma diagnostics (intrusive and non-intrusive)
- Electronegative plasmas

Series B: “Electrodynamics and fluid dynamics for plasma physics”, Dr Matthew Hole, ARC Future Fellow, Research School of Physics and Engineering, ANU.

Electrodynamics and the dynamics of charged electrical fluids are foundation descriptions of plasmas. The course aim is to consolidate understanding of electromagnetic theory, and to introduce some of the mathematical models used to describe plasma behaviour. An emphasis of the course will be on problem solving, and using the techniques to describe behaviour in plasmas. Specifically, the course will cover

- Electrostatics (Poisson and Laplace equation)
- Magnetostatics (Quasi-static magnetic fields; eddy currents, diffusion)
- Maxwell’s equations.
- Plasma kinetic theory: Vlasov equation, Fokker Planck equation, fluid equations.

Series C: "Toroidal Magnetic confinement: equilibrium and stability", Dr Sergei Sharapov, Culham Centre for Fusion Energy (UK)

Experiments on magnetic nuclear fusion reveal a variety of MHD modes excited by fast ions. In view of the next-step burning plasma experiment with significant population of fusion-born alpha-particles, a systematic experimental and theoretical study was performed during past two decades for assessing the role of fast ion driven modes in fusion plasmas. These lectures will present main results of this study explaining how theory in this area drove the experiment and how the novel diagnostics required for such experiment made a significant impact on other studies in the magnetic fusion. The lecture titles are as follows:

- Introduction to magnetic nuclear fusion
- Basics of ion confinement, orbits and heating
- MHD description of plasmas, equilibrium of tokamak plasma
- MHD waves and global Alfvén eigenmodes
- Fast particle driven Toroidal Alfvén Eigenmodes
About the lecturers:

Series A. "Fundamental plasma processes in low temperature plasmas: Discharges, heating, diagnostics and applications", Dr Cormac Corr, Research Fellow, Research School of Physics and Engineering, ANU

Cormac obtained an honours degree in Applied Physics (1999) and a PhD (2003) titled "A study of instabilities in electronegative rf-driven discharges" from Queens University Belfast (Belfast, Northern Ireland). After his PhD, Cormac spent three years working at the Laboratoire de Physique et Technologie des Plasmas (LPTP), Ecole Polytechnique in Paris. He commenced work at the ANU in 2006. His main research field is plasma physics and plasma processing. Cormac has undertaken a wide variety of laboratory plasma research with particular emphasis on combined experimental/modelling studies. Current and previous research activities are radio-frequency plasma discharges, negative ion plasmas, plasma stability, plasma waves, plasma double layers, plasma processing, and plasma diagnostics.

Series B: “Electrodynamics and fluid dynamics for plasma physics”, Dr Matthew Hole, ARC Future Fellow, Research School of Physics and Engineering, ANU.

Matthew holds degrees in Physics, Mathematics and Electrical Engineering, and completed a PhD on plasma centrifuge physics at the University of Sydney. During 2001-2002 Matthew worked for the U.K. Atomic Energy Authority on fusion power on the innovative spherical tokamak concept. From 2003-2004 Matthew worked on space plasma physics in the School of Physics at the University of Sydney. Since 2005, he has worked with Prof. Dewar of the Plasma Theory Modelling Group at ANU. His current and previous research interests include Fusion Plasmas, Vacuum Arc Centrifuge Plasma, Astrophysical and Space Plasmas, Plasma Propulsion, Plasma Instabilities.

Series C: "Toroidal Magnetic confinement: equilibrium and stability", Dr Sergei Sharapov, Culham Centre for Fusion Energy (UK)

Sergei graduated from Moscow Physical-Technical Institute in Experimental Nuclear Physics in 1985, and completed a PhD on physics and chemistry of plasma at this Institute in 1988. He started to work at the Joint European Torus (JET) in 1993 and is presently working at JET and MAST at CCFE, Culham. His interests include energetic particle physics and plasma instabilities in fusion grade plasmas.