



Volume 38 Number 39

5 - 11 October 2012

FROM THE DIRECTOR'S OFFICE

Dr Maarten Vos has been appointed as Head of the Department of Atomic and Molecular Physics Laboratories for a two year term starting 1 October 2012. The School extends its congratulations to Maarten on this appointment.

FOUNDER'S DAY

The Director warmly invites the RSPE community to celebrate Founder's Day next Friday 12 October. Please see the attach program for details of the talks and other activities.

DEVELOPMENT DAY



Life after Physics at ANU: Where Physics & Engineering can take you

Dr Gregory Clark, Professor John M. Poate, Dr Scott Rashleigh and Dr Charles Leedman

Four RSPE Alumni and members of the Development Board share the extraordinary story of their careers

4:00-5:30pm Thursday 18 October

Leonard Huxley Theatre

Snacks will be provided in the RSPE tearoom from 3:30pm

AUSTRALIA'S ENERGY FUTURE

Tuesday 30 October 2012 8.30am for 9am – 5.15pm followed by facilities tours Drew Clarke Secretary of the Department of Resources, Energy and Tourism Professor Joachim Luther Former Director of the Fraunhofer Institute for Solar Energy Systems; and former Head, Solar Energy Research Institute of Singapore; and other speakers from industry, academia and government

Leonard Huxley Theatre Level 2, Leonard Huxley Building 56, Mills Road, ANU

Registration required & further enquiries

Registration ausenergyfuture.eventbrite.com

This forum is free and open to the public

Information crawford.anu.edu.au/events/content/more.php?id=7661

Enquiries E.events.coombs.forum@anu.edu.au T 02 6125 7067

ANU PUBLIC LECTURE SERIES

The nature of time

Dr Peter Riggs

Visiting Fellows, DQS

Thursday 11 October, 6.00pm

The Finkel Lecture Theatre, JCSMR, Garran Road

Registration required:

W anu.edu.au/publiclectures

T 02 6125 4144

[E events@anu.edu.au](mailto:E.events@anu.edu.au)

This lecture is free and open to the public

PHYSICS EDUCATION CENTRE REPORT

Dr Patrick Kluth has taken on the role of third year special topics coordinator within the Physics Education Centre (PEC). This is an important role in the School. In this role, Patrick will match third year students who wish to undertake a research project with appropriate supervisors and will manage the special topics program. Third year special topics are often a student's first exposure to academic life outside the classroom. Many students enjoy the experience and continue on to honours and PhD as a result of their third year research experience. Patrick will make an important contribution to RSPE through this role. If academic staff in RSPE wish to run a third year research project under this arrangement, please contact Patrick.

Dr Sudha Mokkalapati has taken on the role of third year course coordinator. Again, this is a very important role in our undergraduate program. Sudha's contribution will be much appreciated by the School. Starting this December, PEC plans a review of our undergraduate curriculum including a comparison between our courses and those taught by prestigious international institutions in the USA and in Europe. As third year coordinators, Sudha and Patrick will have significant involvement in this process. Both Patrick and Sudha are from EME. It is good to see EME giving such strong support to the undergraduate program.

Professor Anatoli Kheifets from AMPL has taken on the role of dual Honours Convenor and will work with our existing Honours Convenor, David Williams from Applied Mathematics. Honours convening is a critically important role in RSPE, and Anatoli's contribution along with David Williams' continued contribution will be very important to the success of the program. This increased support from AMPL on top of AMPL's already substantial contribution to teaching is much appreciated by PEC.

At the last PEC meeting, **Joe Hope** from the Department of Quantum Science gave a very informative overview of the undergraduate courses taught in physics at the ANU. The meeting was well attended by RSPE staff. In the next meetings, we will focus on teaching methods by asking experienced lecturers to present part of their "favourite lecture" and then discuss the techniques they use to make their lecture successful. The first of these discussions will be led by Dr Nick Robins who leads our Foundations Physics Course. The next meeting will be held at **2:00 pm on Wednesday 17th of October** in the new teaching room Huxley H4.20 which is located near the School Computing Unit. PEC encourages all academic staff involved in teaching or interested in teaching to attend this discussion. The aims of these meetings are that they are informative and enjoyable.

Founder's Day

2012

Celebrating

60



*Years of Physics
at AMU*

RSPE Founder's Day 2012

Friday 12 October

*A celebration of current achievements in research
and 60 years of physics at ANU*

Program

8.30am Oliphant Building 60, Mills Road, ANU Campus

Technical displays available for viewing in RSPE foyer

9.00am Leonard Huxley Theatre, Building 56, Mills Road, ANU Campus

Introduction by the Director

Professor Stephen Buckman

2012, the year in review

Announcement of awards and prizes

9.45am

Fluids in porous media – new insights from tomography and microscopy

Dr Andrew Fogden, Applied Mathematics

Multiphase fluid transport through porous media is central to a vast number of natural and industrial processes, such as recovery of oil, remediation of oil contamination and sequestration of carbon dioxide. The macroscopic flow response is dictated by the accumulation of the chain of microscopic events set in motion as one fluid displaces another from individual pores. The state-of-the-art in prediction of the fate of these processes combines x-ray micro-tomography of the porous medium with modelling and simulation of transport in the 3D digitised pore space. However, the predictive power of such approaches is currently limited by lack of knowledge of the underlying interfacial interactions and their consequences. Increased insight has recently been obtained by visualisation of the actual configurations of fluid interfaces in pores. This progress will be illustrated by results of the imaging of oil and water in sandstone and carbonate rocks during drainage and imbibition.

10.00am

Webcast Worked Examples - an unreasonably effective teaching method?

Dr Paul Francis, Physics Education Centre

Over many years, we have experimented with a wide variety of new teaching techniques in first year physics. A few are disasters, most make no measurable difference to student learning, but every now and then, we stumble across a technique that makes large and measurable improvements in student learning. One such technique is webcast worked examples, where we record ourselves solving a problem and post the video with voiceover online for the students. We solve the problems "cold" so we make (and recover from) mistakes, and go down blind alleys. The use of these webcasts has led to dramatic (and rather unexpected) improvements in student learning. For example, the fraction of students spontaneously checking their answers under exam conditions has risen from under 10% to around 60%.

10.15am

Rare-earths meet silicon: a quantum leap in quantum jumps

Dr Matthew Sellars, Laser Physics

In collaboration with the University of NSW, ANU and Melbourne University we have developed a transistor, which detects the quantum state of a single erbium ion. It is the first step in integrating the ANU optical quantum communication technology with the silicon-based quantum computing technology of UNSW and Melbourne.

10.30am Leonard Huxley tearoom and courtyard

Morning Tea

11.00am

From magic to applied science: unveiling the potential of metamaterials

Dr Manuel Decker, Non-Linear Physics

When the concept of metamaterials was introduced in 1999 by Sir John Pendry a whole new fascinating playground opened up for scientists all over the world. With new inspiring concepts like perfect imaging, negative refraction, hyperlenses and even invisibility cloaking, science seemed to enter the magic world of Harry Potter. However facing fundamental limitations of causality and light absorption, many of those concepts turned out to be truly impossible for the Muggle-born. Nevertheless there are still many exciting practical applications to explore. In a combined effort between several departments in theoretical modelling, nanofabrication, and optical characterisation, we show how metamaterials can be used to amplify and direct light for the next generation optical devices.

11.15am

Going right to the source – plutonium in a coral from Enewetak Atoll

Prof Keith Fifield, Nuclear Physics

For several years, we have been using the infinitesimally small amounts of plutonium in surface soils to quantify recent, anthropogenic rates of soil loss. The 14UD accelerator is at the heart of the exquisitely sensitive atom-counting technique, developed in the Department of Nuclear Physics, that is crucial for these measurements. The plutonium that we measure was fallout from the nuclear tests in the 1950s and 1960s, and is an average over the nuclear testing era. A major contribution came from the American tests at Bikini and Enewetak Atolls in the Pacific. Now, using a drill core from a coral that was growing in the lagoon of Enewetak Atoll throughout the testing period, we have been able to map out the contributions from individual tests. This is a story that also involves drones, the creation of new elements, and the synthesis of elements in stars.

11.30am

Nanowires for Next Generation Optoelectronics

Dr Patrick Parkinson, Electronic Materials Engineering

While the potential of both nanotechnology and nanoelectronics have been appreciated for decades, only recently have high-quality materials and structures become available to fulfill the promise of novel, cheaper, faster and smaller electronics. One promising candidate for high-density, high-quality nanoscale components is semiconductor nanowires. Over the past half-decade, these structures have gone from a novelty, to device-ready status; in this talk, I review the progress on designing, creating, fabricating, characterising and using nanowires devices within Electronic Materials Engineering and their promise for the coming year.

11.45am

Move over Wireless - here comes Fibreless!

Dr Gerard Borg, Plasma Research Laboratory

As Einstein once explained... "wire telegraph is a kind of a very, very long cat. You pull his tail in New York and his head is meowing in Los Angeles...and radio operates exactly the same way: you send signals here, they receive them there. The only difference is that there is no cat." We cannot deny the similarity between wireless and cats. Wireless links are short like real cats. They hog resources and they do not cooperate - just like cats. Around Canberra there are perhaps hundreds of mobile phone towers, tens of thousands of mobile phones and thousands of WiFi routers installed in homes. We are led to believe that a single band of radio spectrum can only be operated in one location at a time and that power restrictions to avoid interference imply that remote areas cannot be serviced by wireless. But is this really the case? In this talk I will debunk this myth and show that it is possible to achieve the holy grail of absolutely secure, green and ubiquitous wireless communications at fibre speeds. In this talk I'll show you how to kill the cat and upgrade to fibreless.

12 noon

Nonlinear Ops: Going Rogue

David Kedziora, Theoretical Physics

Ever since the existence of deep-water rogue waves was confirmed in 1995, there have been significant attempts to understand and replicate the phenomenon within both oceanic and optical systems, as well as many other fields. Theoretically, the prototype of a rogue wave is generally considered to be the Peregrine soliton of the nonlinear Schroedinger equation, with modifications depending on practical context. However, this first-order solution is arguably limited; too simple for nature and too unambitious for the laboratory. In its stead, we reveal the complicated but elegant forms of higher-order structures, both simulated and observed. Early warning systems can be designed when we understand these extreme waves at the fundamental level.

12.15pm

Control of quantum systems: exploring the strength of weak measurements

Dr Andre Carvalho, Quantum Science

Control techniques have been crucial to the development of most modern machines. As scientific and technological advances allow us to build devices that are so small that quantum effects can be explored, one can expect that control techniques will also be important in the design of quantum enabled technologies. In this talk I will discuss some of the strategies in quantum control, focusing on the fundamental issue that distinguishes control methods in quantum and classical systems: the effect of measurement. In particular, I will discuss how different measurement strategies, possibly complemented by feedback methods, can be used to steer the dynamics of quantum systems.

12.30pm

Thinking globally, acting locally: Applying physics, chemistry, and engineering on a research journey from Venus to Canberra ... and back?

Dr Frank Mills, Atomic and Molecular Physics Laboratories

40 years ago we were in the midst of determining how chlorine chemistry worked on Venus and what effects the space shuttle might have on the stratosphere. Those research efforts came together to yield, first, a Nobel-prize-winning prediction that chlorofluorocarbons (CFCs) could seriously deplete the Earth's ozone layer and, later, a landmark international treaty, the Montreal Protocol on Substances that Deplete the Ozone Layer. We now face a similar but even larger environmental challenge. Solar energy will be an important element of the energy change needed to reduce greenhouse gas emissions, and new research at the ANU and NICTA may help transform solar energy into the dominant source of electricity for the ACT. The first of a series of projects is deploying instruments across the ANU campus to determine the spatial, temporal, and spectral effects of clouds on sunlight in Canberra.

1:00pm

Barbeque lunch

Tearoom, Oliphant Building #60