The Bulletin 385

The Royal Society of New South Wales

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Future Events

Wednesday 4 March 2015
1230th Ordinary General Meeting
Super-resolution microscopy:
Understanding how T cells make decisions
Delivered by:
Scientia Professor Katharina Gaus
Union, University & Schools Club
25 Bent St, Sydney
6:00 for 6:30 pm
Dress code: Jacket and tie

Wednesday 18 March 2015
Joint meeting of RSNSW with the Australian Institute of Physics
Quantum emitters in wide band gap semiconductors
Delivered by:
Associate Professor Igor Aharonovich
Trinity Grammar School PD centre
5 Thomas Street, Lewisham
6:00 for 6:30 pm

Wednesday 1 April 2015
Annual General Meeting followed by 1231st Ordinary General Meeting
Is the Brain the Right Size?
Delivered by:
Scientia Professor George Paxinos AO
Union, University & Schools Club
25 Bent St, Sydney
6:00 for 6:30 pm

Wednesday 22 April 2015
Clarke Memorial Lecture
Professor Bill Griffen
Professor of Geology,
GEMOC ARC National Key Centre,
Earth and Planetary Sciences,
Macquarie University

(Continued on page 2)

Wednesday 4 March 2015

Super-resolution microscopy: Understanding how T cells make decisions

Scientia Professor Katharina Gaus
ARC Centre of Excellence in Advanced Molecular Imaging
NHMRC Program in Membrane Interface Biology, UNSW

and 1230th Ordinary General Meeting
Union, University & Schools Club , 25 Bent St, Sydney
6:00 for 6:30 pm
Enjoy a welcome drink from 6:00 pm

Book for dinner after the meeting: $75 per head

Professor Gaus is an NHMRC Senior Research Fellow at the University of New South Wales. Her research focuses on developing new super-resolution fluorescence microscopes and analysis routines to map the decision-making processes of T lymphocytes in peptide-mediated immunity.

The decision of a T cell to activate or not activate is determined by an intracellular signalling network. In this decision-making network, information is not simply encoded into the expression of components, but in the frequency and duration of their interactions. This makes T cell signalling a fundamental 'single molecule problem'.

Her team has established single molecule imaging to analyse the distribution of T cell signalling proteins in intact and live cells on the molecular scale. In her talk, Professor Gaus will present some of the data to illustrate how recording the behaviour of a single molecule within the networks gives us clues as to how the decision-making network functions as a whole. She believes that such information not only allows us to understand a complex cellular network but also provides new avenues for drug design to combat autoimmune diseases and agents for cancer immunotherapy.

From the President

As mentioned in my report last month, the Council has started a process of consultation to engage with as many of our members as possible so that we can create a future for the Society that maximises opportunities for engagement and enables us to make a substantial contribution to Australia's intellectual life. The Council met for a working session recently and made an excellent start to the preparation of a Green Paper for circulation to the membership. It is expected that this will be published at the end of this month, in time for distribution before the March OGM. We also intend having a separate session in mid-March where this paper can be discussed and White Paper made ready for recommendation to the membership at the AGM on Wednesday 1 April. We anticipate that this will be another major step forward for the Society in re-establishing its leadership in the intellectual life of NSW.

With the AGM now only about six weeks away, please give consideration to nominating for a role on Council. We are fortunate to have seen a substantial growth in membership over the last year or so, many of whom are Fellows of the Society – it would be good strong representation from these new members on Council. If you are interested and would like to know more about what this entails, please contact me.

At the AGM, the Council will recommend some changes to the By-Laws of the Society, continuing improvements that we have made over the last 18 months to the way in which the Society functions. These proposed changes will be circulated well before the AGM so that members can consider them fully.

The Council is excited and enthusiastic about the new directions that we are charting. This is a consultative process and we would like to hear from any member of the Society who would like to contribute to this discourse. As always, I am easily contacted by email at president@royalsoc.all.au and would like to hear from you.

Donald Hector

Photo Gallery

RSNSW Scholarship Winners for 2014

Brynn Hibbert, Steven Parker, Melanie Laird, Ruth Wells, Donald Hector

INVITATION TO JOIN THE COUNCIL

The Rules of the Society require that the officers bearers be elected at the Society's Annual General Meeting held in April each year. Nominations must be received by the Honorary Secretary by the 15th day of March.

Nominations must be proposed and seconded by two financial Full Members or Fellows of the Society and accepted by the nominee.

Nomination Forms are available from the Society's office and may be returned by post to the Honorary Secretary at the Society's office or scanned and sent by e-mail to secretary@royalsoc.org.au.

(Continued from page 1)

SOUTHERN HIGHLANDS BRANCH

Thursday 19 March 2015
Gastrointestinal Microorganisms and disease
Delivered by:
Professor Andrew Holmes of
University of Sydney
The Performing Arts Centre,
Chevalier College, Bowral
6:30pm
For more upcoming events see website
www.royalsoc.org.au

Report of the meeting between the

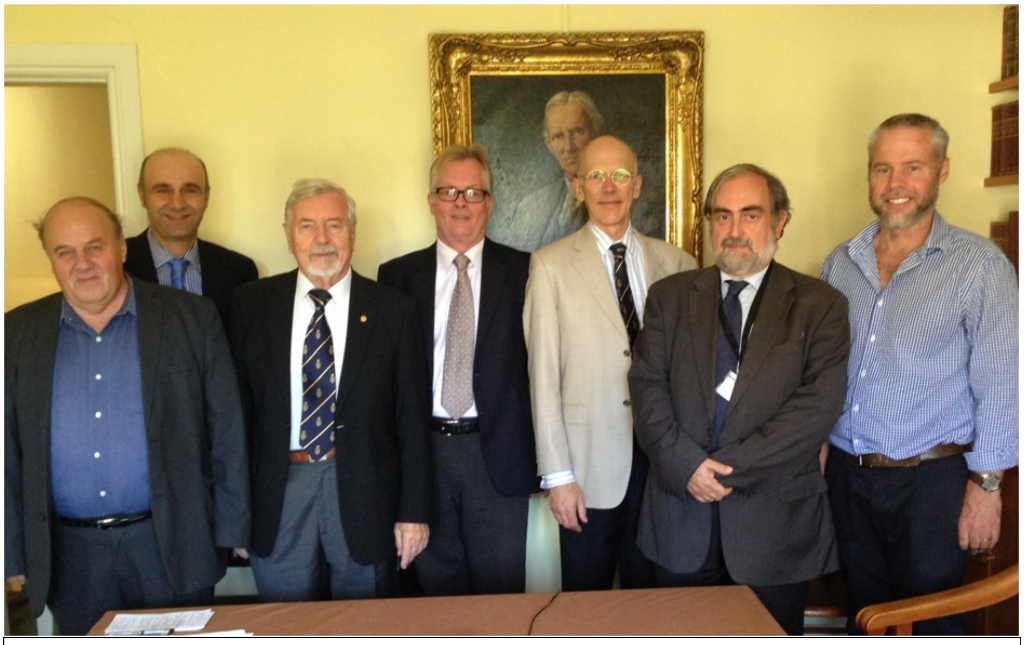
Royal Society of NSW and the

International Center for Zetta-Exawatt Science and Technology (IZEST)

held on Thursday 29 January 2015 at the Society's offices

In 2014, the Society entered into collaboration with International Center for Zetta-Exawatt Science and Technology (IZEST), a major project sponsored by number of European Union countries to create the first international centre dedicated to the exploration of the fundamental physics of, high-energy, high intensity lasers. This is at the frontier of contemporary physics. The Society has offered to provide a neutral place in Australia for the discussion of emerging research and other ideas and to engage with interests outside the specific area of high-energy lasers and their application to peaceful, non-military purposes. The main Australian participants in this programme are the Centre for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS) directed by Professor Ben Eggleton FRSN and the Australian Nuclear Science and Technology Organisation (ANSTO), in particular the hadron cancer-therapy group under the direction of Professor Richard Banati FRSN. Professor Heinz Hora FRSN and Dr Fred Osman MRSN are the convenors of the programme for the Society.

In January, two participants in the research programme from Europe visited Australia to discuss the research. They are Professor Stavros Moustaizis, of the School of Production Engineering and Management, Chania, Greece and Professor Paraskevas Lalousis of the Institute of Electronic Structure and Laser in Heraklion, Greece. It is anticipated that an international workshop on the programme can be arranged in Sydney during 2015.



Paraskevas Lalousis, Frederick Osman, Heinz Hora, John Hardie, Donald Hector, Stavros Moustaizis and Ben Eggleton

IZEST Partner Spotlight: *Laser-driven Fusion*
RSNSW - Australia

Laser interaction with plasmas is studied at the University of New South Wales in Sydney/Australia since 1975, now together with other Australian activities under the auspices of the Royal Society of NSW. One of the theoretical/numerical results in 1978 was the ultrahigh acceleration of about solid density plasma blocks by 10^{20} cm/s^2 within picoseconds to velocities above 10^9cm/s. The agreement with experiments could be shown by Sauerbrey only after Mourou's et al. CPA laser pulses above Terawatt were available in 1996. These picosecond pulses converted laser power directly into few micrometer directed plasma blocks with ultrahigh ion current density to initiate the Chu-Bobin fusion flames in solid density fuel. This nonlinear energy conversion avoided inefficiencies known from thermal pressure and instabilities of nanosecond interactions. Very detailed evaluations showed how proton-^{11}B (HB11) fuel with negligible emission of nuclear radiation can be ignited in a similar way as DT. A spherical ps laser irradiation with up to an Exawatt CPA laser is needed. A design with one meter radius (Fig. 1) is proposed for ICAN-IZEST in the following references[1][2]. When using the new 10 kilotesla magnetic fields for cylindrical confinement, a 30 PW-ps laser pulse in solid HB11 may produce GJ of energy in alpha particles (Fig. 2) whose energy can be converted directly into electric power [3]. Parallel to other work on CPA acceleration of very intense ion beams in the 100 MeV range for hadron cancer treatment, the mechanism of the ultrahigh plasma block acceleration is being studied [4].

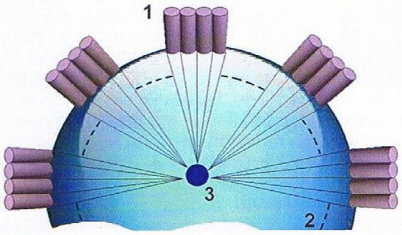


Fig.1 Radial fiber ICAN with 1m radius for exawatt laser pulses [1]

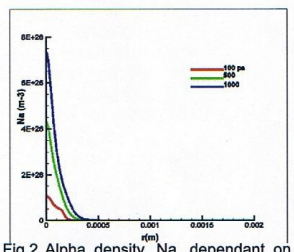


Fig.2 Alpha density, Na, dependant on radius, r, at different times (from lowest to highest curves for 100, 500 and 1000 ps respectively) showing ignition from the increase of the curves [3].

-H. Hora,
Professor

www.izest.polytechnique.edu *page 6*

Report of the Four Societies Meeting

held on Monday 16 February 2015 at Clayton Utz, Sydney

Latest Developments in Small Modular Reactors

An outstanding event with Dr Adrian Paterson, CEO of ANSTO

Energy is an integral component of modern life like a fundamental element. The largest source of energy is fossil fuel which we know has significant CO_2 issues. The second largest source is nuclear, using uranium. Dr Paterson began his talk by showing that the country generating the most energy per capita is France with its successful harnessing of nuclear technology, but interestingly Brazil is also successful with its use of ethanol from sugar cane. Australia was shown to be in the worst sector with almost the highest cost per capita of electric power generation, more than twice as expensive as France and similar to the high cost in Denmark which relies heavily on wind energy.

Denis Cooke (AIE), Adi Paterson (ANSTO), John Hardie and Heinrich Hora (RSNSW)

Dr Paterson is a world authority on Small Modular Reactors (SMRs). He stated that this new type of nuclear reactor is given too little attention against the backdrop of the very large power reactors, such as China's new 1750 MWe power plant in Taishan, which have captured our attention until now.

China has had a meteoric rise in the development of its nuclear reactor technology over the last 20 years. However, Westinghouse appears to be leading the way with its rapid development of SMRs, but Russia is also moving in this direction. The best results have been obtained in China which can sell at a reasonable cost for establishing fully functional SMRs with 250 to 300 MWe within 4 years (not the 15 years it has traditionally taken for the large reactors). They are built in the form of modules which are then shipped from the factory to sites which may be in relatively close proximity to dense populations due to the fact that they only need a smaller safety radius. It should be noted that an experienced Australian team of specialists with Dr. Paterson at ANSTO is working with China on this project.

Dr Paterson touched on Australia's recent shifts politically in which the nuclear component of an optimal energy mix is growing in acceptance, as seen from the recent announcement of a Royal Commission in South Australia, in view also of its rich resources of uranium. The lecture showed how SMRs are ready to fill the vacuum in many similar countries like Australia.

Once again, the Four Societies Lecture was an outstanding success with a full house attending. The Society thanks the Australian Institute of Energy for organising this year's event and Clayton Utz for supporting it.

Heinrich Hora

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