



The Bulletin 403

The Royal Society of New South Wales

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29 September 2016

For Your Diary:

Wednesday 13 October 2016

Dirac Lecture

Duffield Professor Kenneth
Freeman, FRS

“Dark Matter in the Universe”

5:45 pm

Tyree Room

John Niland Scientia Building

University of New South Wales

Thursday, 20 October 2016

Southern Highlands Branch
Lecture

Professor Gordian Fulde
Emergency Practice

6:30 pm start

Chevalier College, Bowral



Patron of The Royal Society of NSW

His Excellency General The Honourable

David Hurley AC DSC (Ret'd)

Governor of New South Wales

Public Lecture & 1247th OGM
Wednesday, 5 October 2016

Prof Itai Einav

School of Engineering, University of Sydney

“From Sand and Rice Bubbles
to Earthquakes and Volcanoes”



The Universe is granulated. Stars, planets, and asteroids are all relatively small particles when compared to galaxies (themselves appearing as particles when seen from afar). They are relatively huge when compared to sand particles. The number of atoms in a single particle of sand is roughly the same as the number of sand particles in Australia’s beaches, somewhere in the vicinity of 10,000,000,000,000,000,000. Together with dry rice, M&Ms, and pharmaceutical powders, sand particles belong to the class of granular materials (*For more information, go to page 6*)

Date: Wednesday 5 October 2016: 6:00 for 6:30 pm

Venue: Union, University and Schools Club, 25 Bent Street, Sydney

Entry: \$20 for Non-Members, \$10 for Members and Associate Members of the Society, which includes a welcome drink.

Dress: Business

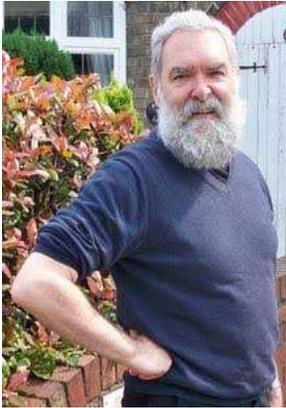
Dinner (including drinks): \$80 for Members and Associate Members, \$90 for Non-Members. Reservations must be made at least 2 days in advance

Reservations: <https://nsw-royalsoc.currinda.com/register/event/22>

Enquiries: royalsoc@royalsoc.org.au Phone: 9431 8691

All are welcome.

From the President



When the Bulletin goes to press I shall be on the East Coast of the USA, possibly listening to the first Presidential debate. I think I am glad I do not have to engage directly with that particular merry-go-round, but of course we all will suffer the consequences whoever wins.

This is not to say that Australia does not have its own share of bizarre politicians. Senator Malcolm Roberts used his maiden speech this week to spell out a woeful lack of understanding of basic physics and chemistry. “It is basic. The sun warms the earth's surface. The surface, by contact, warms the moving, circulating atmosphere. That means the atmosphere cools the surface. How then can the atmosphere warm it? It cannot. That is why their computer models are wrong. The UN's claim is absurd.”

Matthew England FRSN was quoted as responding “Where do you start? This denies that the atmosphere has any heat storage capacity, or that greenhouse gases re-radiate heat back down to the Earth. This really is high school geography that Malcolm Roberts has messed up here. We have known about the greenhouse effect since about the middle of the 19th century.”

It is difficult to know what the Royal Society can do to add its weight to the outcry that followed Senator Roberts' speech, other than to speak out as often and as loudly as possible. I did wonder if we could issue a challenge to schools to devise the most simple demonstration that air (or carbon dioxide) does take up heat. A bus load of

schoolkids outside Parliament with said demonstration might grab the Senator's attention. If you have any ideas do let me know at president@royalsoc.org.au.

On a happier note, I am exceptionally pleased to congratulate Ann Williamson FRSN on her award of the 2016 Australasian College of Road Safety Fellowship which was presented by Hon Darren Chester MP (Federal Minister for Infrastructure and Transport) and Mr Lachlan McIntosh AM (President ACRS), at Parliament House, Canberra this month. Professor Williamson was the founding Director of the Injury Risk Management Research Centre and the Transport and Road Safety Research Centre and is Australia's leading expert on driver fatigue and heavy vehicle safety. Ann has her work cut out; the aim is to halve road and death injuries by 2020.

Our Membership and Fellowship numbers are growing very nicely, and we are now talking seriously about what makes a potential Fellow who might not come from a regular academic background (and therefore instantly fulfil criteria such as a PhD, publications). This discussion relates to our attempts to move into the fields of “Literature Philosophy and the Arts” and identify leaders and people of excellence who are contributing to NSW society in these areas. Any Member or Fellow can nominate a potential Fellow and we encourage them all to think of leaders in their circles of society who could be active FRSN. Go to our new web site (<http://royalsoc.org.au>) and click on the Membership tab for information and forms.

The web site was launched just before the September OGM to very little fuss and some compliments. Please send any comments to our sterling web master Chris Bertram (webmaster@royalsoc.org.au), who, with Jeremy Webster of Ezerus, has the thanks of the Society for our new internet presence. As ever news, plaudits or abuse, please, to President@royalsoc.org.au.

August 2016

Brynn Hibbert

**Public Lecture & 1246th OGM
Wednesday, 7 September 2016**

Mr. Richard Neville

Mitchell Librarian and Director, Education & Scholarship

“A Source of Inspiration and Delight: The Mitchell Library”



In many ways, the State Library of New South Wales’ history and development runs in parallel to that of the Royal Society of New South Wales and it also holds some of the early archives of the Royal Society of NSW.

Richard Neville, the Mitchell Librarian and Director Education & Scholarship at the State Library of NSW, recounted the beginning of the library as a circulating library. David Mitchell was a wealthy colonialist and concentrated on collecting Australiana. From his donation of 1,000 books, the library started as a subscription library in 1826, but it was not open to women.

In 1869, the government purchased the library, and it was relaunched as a free library with a collection of approximately 150,000 books. The library content was typical for a provincial

English town. Although considered remote from the city centre, it was very successful and had about 50,000 visitors a year. Richard showed some paintings that illustrated the situation of the library over this period.

In 1879, a lending service was established that was linked through the Sydney Mechanics’ School of Arts (SMSA). Subsequently, various NSW libraries were established for parliament, Sydney University, and the State Library. In the early 20th century, a new library was constructed and named in Mitchell’s honour. Another donor was Sir William Dixson whose collection of pictures, manuscripts, and other material passed to the library after his death in 1952.

The appointment of a female Mitchell librarian – Ida Leeson – in the 1930s, caused controversy, and a new position was created to sit above the librarian. John Metcalfe filled the role. He founded the Australian Institute of Librarians, the first professional body.

Since 2000, the acquisition fund of the library has remained stable. The collection, valued at approximately 3.1 billion dollars, now includes photos and architectural plans. All catalogues are now online, and more and more of the collection is being digitised. Following the talk, the discussion embarked on connections to other state libraries. These institutions run rather separate lives. Conservation, especially of digitised material, is a big issue, for example with regards to archiving emails of eminent people.

Report of 15 September 2016 Meeting

Royal Society

Southern Highlands Branch

Speaker: Associate Professor Anthony Masters
Chair of the University of Sydney Academic Board
and Fellow of the University Senate



“If we are unable to hand over to our children and their children, the means to at least as good a lifestyle as that we now enjoy, we have failed miserably as a civilization. This challenge become more acute as we approach the resource and energy limits of our planet. To even approach a “sustainable” existence, such that the ecosphere exists in a “steady state” able to support our current lifestyle, a 4 to 10-fold increase in the resource efficiency of existing production processes will be necessary.”

These words by Tony Masters aptly describe the philosophy behind his team’s research at Sydney University. In this lecture, Tony spoke to the 42 person audience of two major research projects currently being undertaken. The first is examining the catalytic generation of fuels and specialty chemicals from renewable resources such as biomass, water and the sun. The second concerns novel battery technologies for improved energy storage. In all of this research, the emphasis is on using earth-abundant materials as catalysts; wastes, non-potable water and other sustainable and renewal resources provide feedstocks for green chemistry processes.

These research projects have been so successful that already the team has spun out two companies, Gelion and Licella. At Gelion, the company is developing batteries made with nano-structured gels which claim better performance than lithium ion batteries in their charging and discharging speed, as well as being smaller, safer, more durable and cheaper. These gel flexible batteries have the potential to be 3-D printable and offer the possibility of being incorporated into the walls of buildings because of their “bendy” characteristics. They differ from zinc-bromine flow batteries in that they use a gel instead of a liquid.

According to Gelion, the charge time for the battery has come down to just a few minutes, while its efficiency is at 90%, which is higher than in our mobile phones. Its increased safety over lithium batteries comes from the fact that the gel is made of fire-retardant material. Although the nano-structured gel allows the batteries to be used in smaller appliances such as cars, computers and mobile phones, the initial target market for Gelion’s batteries is for energy storage in buildings, both residential and commercial. The “bendy” nature of the batteries has caught the attention of the building industry, including big name players such as Lend Lease. They see a future where flat-pack zinc-bromine batteries could be included into the very fabric of buildings, such as in prefabricated wall segments for example.

Tony Masters is a Fellow of the Royal Australian Chemical Institute. His research has produced over 150 papers and patents, over 50 conference presentations and gained over \$8 million in research support. Collaborations have involved researchers from the Universities of Sydney, Melbourne, Monash, Murdoch, Southampton, Liverpool, Witwatersrand, Venice, Cardiff, James Cook, Ben-Gurion and Cambridge. Other collaborations have involved researchers from CSIRO, DSIR New Zealand, The Royal Institution UK, TU Delft NL, and the Sydney College of the Arts. As for collaborations with industry, researchers involved have come from DSM Netherlands, Alpha Chemicals, Australian Biodiesel, Redflow, ZBB, Licella and Ignite Energy.

Most recently, successful ARC Linkage Grants with Professors Maschmeyer, Vassallo and Perrier have funded collaborations with local and international companies to develop improved biomass-derived polymers and novel high density zinc storage batteries.

Anne Wood FRSN

**The Dirac Lecture
with the Award of the Dirac Medal**

**Duffield Professor Kenneth Freeman, FRS
Australian National University**

“Dark Matter in the Universe”

5:45 pm, Thursday 13 October 2016

Tyree Room of the John Niland Scientia Building, UNSW (Kensington)



The Award of the Dirac Medal is based on rules approved by the Vice Chancellor Sir Rupert Meyers of the University of New South Wales on 8 December 1990 following a personal letter of Prof. Paul Dirac donating the royalties of his book *Directions in Physics* (1978), which is based on lectures he gave in Australia in 1975. In its early years, the award was organised by UNSW in conjunction with the Australian Institute of Physics. While the first Dirac award was established at UNSW, Wikipedia now lists three more awards in the the name of Paul Dirac

Paul Dirac (1902-1984) was the Lucasian Professor of Mathematics at the University of Cambridge, also held by Isaac Newton and Stephen Hawking. As a theoretical physicist, Prof Dirac made fundamental contributions to the early development of both quantum mechanics and quantum electrodynamics. Among other things, he predicted the existence of antimatter. Dirac shared the 1933 Nobel Prize in Physics with Erwin Schrödinger, "for the discovery of new productive forms of atomic theory". He also worked on attempts to reconcile general relativity with quantum mechanics.



Professor Freeman’s research concerns the formation and dynamics of galaxies with a particular interest in the problem of dark matter in galaxies. He was one of the first to point out that spiral galaxies contain a large fraction of dark matter. He is active in international astronomy, as a division past-president of the International Astronomical Union, and serves on visiting committees for several major astronomical institutions around the world.

Prof I. Einav ... Continued from page 1

Sand itself is the second-most manipulated material in industry, after water. But the motion of sand particles is far less understood than the motion of atoms in water or the motion of celestial bodies and galaxies. What is it about sand particles and rice bubbles that makes them so hard to describe? What governs their motion, and how can they inform us about important phenomena such as earthquakes and volcanoes?.

Working at the University of Sydney, Professor Itai Einav is the Director of SciGEM (Sydney Centre in Geomechanics and Mining Materials). He is an Honorary Professor of University College London, a Fellow of the Royal Society of NSW, and has held visiting research appointments at Universities in USA, France, Spain and Japan. He is an Editor of *Granular Matter* and sits on the editorial board of *Géotechnique*. He has received several international research awards, including medals from UK's Institute of Civil Engineers and Europe's ALERT Geomaterials. His work crosses many disciplines at the interfaces of Civil Engineering, Physics, Resources Engineering, Geophysics, and Applied Mathematics. Einav's work in the disciplinary area of granular physics has yielded discoveries in heat transfer, mixing, segregation, and melting. More recently he has developed strong affinity to rice bubbles.

Vale: Alan Buttenshaw

It is with some sadness that I record the passing of a former Hon. Secretary, Councillor and long-standing supporter of the Society, Mr Alan Buttenshaw. Alan's funeral was held on Friday, 2 September, in Bowral, and fortunately I was able to represent the Society at it. There was no death or funeral notice in accordance with his wishes. Mention should be made of his passing and of his stalwart support for the Society in a forthcoming Bulletin. He was 76.

**John Hardie FGS FRSN
Vice-President**



Professor Gordian Fulde

Prof. Fulde will be speaking at the meeting of the Southern Highlands Branch, Thursday 20 October. The following is an extract from his commendation at Senior Australian of the Year 2016.

<http://www.australianoftheyear.org.au/>

“From midnight to dawn, while most people are in bed, Professor Gordian Fulde is presiding over one of Australia's busiest emergency departments. The Director of Emergency at St Vincent's Hospital and Sydney Hospital for more than three decades, Gordian is the longest serving emergency department director in Australia. The doctor on call when disaster strikes, Gordian has seen it all and is passionately outspoken about the scourge of ‘ice’ and alcohol-fuelled violence which delivers a flood of people into Australian hospitals each weekend. While you will occasionally see him appear on *Kings Cross ER*, Gordian is also actively involved in teaching and training students and staff in many facets of emergency medicine. A member of the Board of the Thomas Kelly Youth Foundation, Gordian also supports many schools and community organisations, sharing his stories of working in an urban warzone, and warning of the dangers of a binge drinking culture, which is overwhelmingly the main cause of injury in Australia's emergency departments.”

Schedule of RSNSW Events 2016

Date	Event	Speaker	Topic	Location
5-Oct-16	1247th OGM	Prof Itai Einav	From Sand and Rice Bubbles to Earthquakes and Volcanoes	Union, University & Schools Club
13-Oct-16	Dirac Lecture	Duffield Professor Kenneth Freeman, FRS	Dark Matter in the Universe	Tyree Room UNSW
2-Nov-16	1248th OGM: Jak Kelly Award	Prof. E. James Kehoe	Horses for Courses: Advances in Instructional Design	Union, University & Schools Club
17-Nov-16	AIP Postgraduate Awards Day	TBA	TBA	Slade Theatre, University of Sydney
29-Nov-16	Second Society Forum	Contributors from Learned Societies	Society as a Complex System	Government House
7-Dec-16	1249th OGM: Jak Kelly Award	TBA	TBA	Union, University & Schools Club

Southern Highlands Branch - 2016

Date	Event	Speaker	Topic	Location
20-Oct-16	Lecture	Prof Gordian Fulde	Emergency Practice	Chevalier College, Bowral
17-Nov-16	Lecture	Prof. Gordon Wallace	3D Printing of Body Parts	Chevalier College, Bowral

Future lectures and other events will be scheduled, usually for the third Thursday in each month

Contacts for Your Officer Bearers and Council Members

Em Prof D. Brynn Hibbert President: president@royalsoc.org.au
 Dr Donald Hector Vice President: dchector@unsw.edu.au
 Mr John R Hardie Vice President: john.hardie@royalsoc.org.au
 Ms Judith Wheeldon AM Vice President: judith.wheeldon@mac.com
 Mr John Wilmott Treasurer: rjwilmott@gmail.com
 Em Prof Robert Marks Hon Sectry (Editorial): editor@royalsoc.org.au
 Dr Herma Buttner Hon. Secretary: secretary@royalsoc.org.au
 Dr Ragbir Bhathal Hon. Librarian: R.Bhathal@westernsydney.edu.au
 Mr Hub Regtop (Southern Highlands Rep): regtop@ozemail.com.au
 Dr Erik Aslaksen erik.aslaksen@bigpond.com

Dr Mohammad Choucair mohammad.choucair@sydney.edu.au
 Prof Maxwell Crossley: maxwell.crossley@sydney.edu.au
 Dr Desmond Griffin AM: desgriffin@optusnet.com.au
 Em Prof Heinrich Hora: h.hora@unsw.edu.au
 Em Prof Stephen Hill AM: sthill@uow.edu.au
 Prof E. James Kehoe: ejameskehoe@gmail.com
 Prof Bruce Milthorpe: Bruce.Milthorpe@uts.edu.au
 Prof Ian Sloan AO: i.sloan@unsw.edu.au
 Prof Ian Wilkinson ian.wilkinson@sydney.edu.au
 A/Prof Chris Bertram Webmaster c.bertram@sydney.edu.au

The Bulletin is issued monthly by the Royal Society of New South Wales Editor: Prof. E. James Kehoe; Managing Editor: Mr Edward Hibbert

Contact: Ms. Patricia Chiew, Phone: +61 2 9431 8691 Fax: +61 2 9431 8677 Email: info@royalsoc.org.au
 Mailing Address: The Royal Society of NSW, PO Box 576, Crows Nest NSW 1585, Australia

For further information: <http://www.royalsoc.org.au/>