Latest ACT Node Tool Arrival: JA Woollam M-2000D Spectral Ellipsometer

The ACT Node has recently taken delivery and commissioned a new piece of kit in our EBL Laboratory - a Spectral Ellipsometer.

The JA Woollam M2000D Ellipsometer allows accurate measurements of refractive index and thickness of various types of layers spanning dielectrics, semi-conductors and thin metal films.

Some of the system features are:

- Spectral range from UV till mid infrared (193-1690nm) enabling measurement on dielectrics but also on most common GaN-, GaAs- and InP-based layers.
- Automatic angles from 45 to 90˚.
- All wavelengths acquired simultaneously.
- Typical data acquisitions times 1 to 5 seconds.
- Automated Sample Translation for wafer mapping up to 150mm.
- Focused beam size to ~300µm.

The system is supported by powerful software to analyse data with possibility of various models such as Cauchy or Tauc-Lorentz models. The system resolution is as small as 1nm (semiconductor native oxide can be measured).

Through May, we held three two-hour training sessions (12 people in total - see photographs) for this new piece of equipment, with more to be scheduled as required.

This ellipsometer compliments the existing instrument at the WA Node that has a spectral range of 2-20µm.

***Ellipsometer training participants** (all L-R)*

***Top** - Tran Tuan, Sam Turner, Yuanjing Shen, Azul Osorio Mayon and Kaushal Vora (ANFF).*
***Above** - Kidane Belay, Sanjoy Nandi, Xinjun Liu and Kaushal.*
***Below** - Sukhanta Debbarma, Xin Gai, Duk-Yong Choi, Khu Vu and, of course, Kaushal.*

ACT Node User Workshop

The ACT Node is going to hold its first Node Users Workshop on June 25 2013.

The preliminary program is as follows:

***1:30-3:00pm**: Oral presentations of Node users (Huxley Theatre).*

***3:00-3:20pm**: Afternoon tea.*

***3:20-4:30pm**: Poster session (Conference Room, RSPE Link Building).*

***4:30pm**: BBQ or similar.*

If you are interested in presenting your research as either an oral presentation or poster please send a 10-line abstract (with maximum of one figure) to Foaud Karouta no later than June 7, 2013.

If you would like to attend contact Fouad Karouta for more details. There is no fee to participate, however registration is required for catering purposes - contact details directly below.

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chemists and biochemists know about which chemicals stick to each other; what micro-electronic engineers know about making tiny things; and strangely, what physicists know about how butterfly wings bend light, then we can build such a device to check if groceries are fresh, to remotely pick up explosives in an airport, or to test for lung cancer without needing a biopsy.

Gino's work on this project, which has three patents pending so far, is in collaboration with Winthrop Professor John Dell, Dean of the Faculty of Engineering, Computing and Mathematics; Winthrop Professor Lorenzo Faraone, Director of the Centre for Semiconductor Optoelectronics and Microsystems and Director of the ANFF WA Node; Professor Adrian Keating in the School of Mechanical and Engineering; and Professor Mariusz Martyniuk, (Facility Manager of the ANFF WA Node) in the School of Electrical, Electronic and Computer Engineering.

Story and centre spread supplied by Gino Putrino, PhD student at School of Electrical, Electronic & Computer Engineering, UWA.

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ACT Node & WA Node NEWS

ANFF

Providing nano and microfabrication facilities for Australia's researchers

Australian National Fabrication Facility

ACT Node & WA Node

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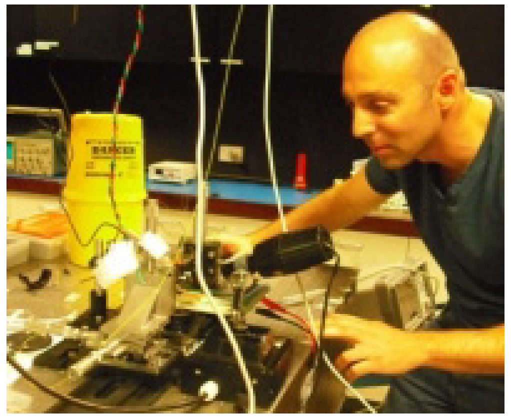
An Artificial Nose! - Explained in Two Minutes

Gino Putrino is a PhD student at the University of Western Australia and one of 12 winners of a world-wide competition for researchers to reduce their work to simple visual ideas that can be understood by everybody. Gino was the only West Australian finalist chosen from among more than 200 competitors that entered an international 'PhD TV 2 Minute Thesis' contest (see centre spread).



Gino Putrino in his lab - photo courtesy of UWA

Gino's project attempts to bring together vibrating mechanical beams, lasers, and butterfly wings to aid in the early detection of lung cancer.

How does it do this? Let Gino explain.

"The air we breath is packed full of invisible chemicals that carry a huge amount of useful information. A sensitive enough artificial nose could decipher this information, making possible the ability to tell if someone has lung cancer simply by sniffing their breath, detecting explosives in an airport, or just telling if vegetables in a supermarket are fresh."

Micro-electro-mechanical sensors (MEMS), a specialty area of research and development at the School of Electrical, Electronic and Computer Engineering and supported by the WA Node of the ANFF at UWA, are a new class of device which have been shown to be sensitive enough to do all these things.

"The way in which they work is like this. You make a suspended mechanical beam, clamped at one end. You then coat it with an substance which sticks to the specific chemical you want to sense. If you hit this beam, it will start vibrating at a speed that is called its natural frequency. If the chemicals you are trying to sense then stick to the beam, that speed will change, and if you are able to detect that change, you have an incredibly sensitive device."

"The problem is that these beams need to be tiny, typically one tenth of a mm long, and the frequency that they vibrate at is over 20,000 times a second. Humans are just too big and slow to see them, so we need to find a way to see what these sensors are doing."

To explain how his PhD solves this problem you need to understand the optical properties of the wings of the Green Hairstreak butterfly. The shimmering colours of these wings are not created by pigments, but rather by nano-structured shapes which create an effect called diffraction, where different colours of light are bent in different directions.

Green Hairstreak Butterfly - photo courtesy of The Dublin Naturalists' Field Club

"If nature can do it, then so can we: by fabricating a similar nano-structure underneath the beam, and aiming a laser through it, the amount of light that reaches the other side will depend on the height of the mechanical beam."

And so by bringing all these things together: what mechanical engineers know about vibrating beams; what

(Continued on page 4)

Well, yes, we now have a Facebook page. In addition to our regular website, we thought Facebook could provide us with access to a broader on-line audience of interested people.

You can visit our Facebook page by clicking on the logo above (if you receive this electronically) or by searching for ANFF to friend/follow us. Of course our website will provide much greater detail than we can put up via Facebook, but the links will be there for you to follow for more information.

And don't worry if you don't have/want a Facebook account - we will continue to produce and distribute this newsletter as well.

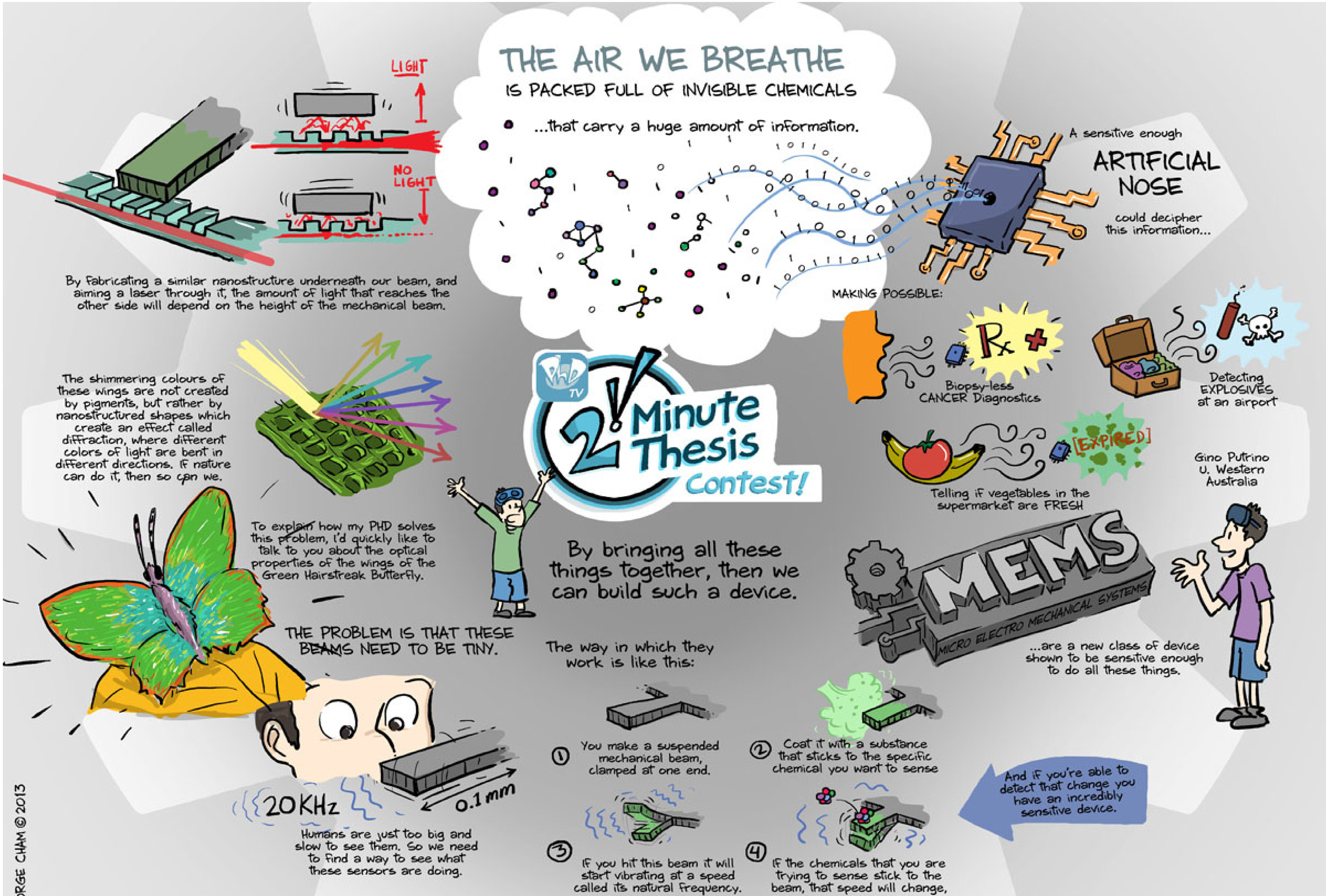
And another first - a four page issue (!) this month thanks to Gino Putrino's contribution of his 'PhD TV 2 Minute Thesis' entry (see main story). You can see the full animated version here or copy the URL overleaf. This could provide some inspiration for our student readers as more of these types of 'layman's' presentations become popular to get your research ideas across.

Finally, we have a brief story on the new Ellipsometer at the ACT Node as well as details of the ACT Node's first User Workshop - see you there!

Next Issue:
due September 2013

ACT Node & WA Node info:

- The ACT Node specialises in III-V compound semi-conductors.
- The WA Node specialises in II-VI compound semi-conductors and MEMS.
- We can provide full support with the use of equipment available.
- Full pricing policy and rates are available on the ANFF website at www.anff.org.au or contact us direct for more information - see contact details overleaf.



See the video of this at - http://www.phdcomics.com/tv/#032