



# NCPST

National Centre for Plasma  
Science & Technology

# The Aurora

FEBRUARY 2011

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## NCPST 2011 and beyond!

Colleagues,

Welcome to the latest edition of the Aurora, the NCPST newsletter. 2010 was another busy and successful year! We had many highlights but for me the European Physical Society 2010 Conference (EPS2010), where we welcomed over 750 scientists to DCU in the summer, was a major positive and enhanced our international profile tremendously.

Our research funding has continued to grow, even in these more challenging economic times, but as we face into 2011 and beyond, we need to continue to vigorously pursue excellence and opportunities to make the NCPST sustainable into the future.

For all the challenges we face, there are even more opportunities. Researchers within the Centre are responding to the changing times and where feasible, pursuing research in new areas e.g. energy, environment and biomedicine.

The national and international funding agencies are increasingly insistent on better industrial engagement, industrial relevance and the commercialization potential of funded projects. I believe the NCPST is well positioned to blossom in

this environment, given the high level of industrial interest in Plasma Technology and its relevance to the Irish economy. I believe our challenge for the next few years is to capitalize on our industrial relevance while at the same time ensuring our students have an excellent learning experience and also keeping our roots and pedigree in basic research.

The development of all researchers and support staff both pre and post PhD is crucial and we need to redouble our efforts with both internal and external stakeholders to constantly improve the opportunities for career development.

We are always open to new ideas and feedback from all members, so please do not hesitate to comment, engage and feed new ideas.



With best regards,  
Stephen

**Stephen Daniels,**  
Executive Director



EUROPEAN REGIONAL  
DEVELOPMENT FUND



## HEA

Higher Education Authority  
An tUdaráis um Ard-Oideachas



## News In Brief

### Postgrad Poster Competition

The 2nd NCPST Postgraduate Poster Competition took place on Wednesday, 8th December 2010. There were over 23 entries from various disciplines within the NCPST. The competition was judged by Professor Miles Turner, Director, NCPST & Dr Stephen Daniels, Executive Director, NCPST.

The winners were:

**Best Poster: Yang Zang:**

**Poster Title** "An Experimental Demonstration of Real-Time Closed Loop Control of a Capacitively Coupled Argon Oxygen Plasma".

**Best Early Stage Researcher**

**Poster: Daniel Molloy:**

**Poster Title** "Plasma Treatment of Polymers for Improved Adhesion".

### Watch the Physics Nobel Laureate lecture

'The Magic of Graphene' a lecture by physics Nobel Laureate Andre Geim is available to watch on the Institute of Physics website. Or simply go to <http://www.iopblog.org/watch-medal-winner-alan-guth-lecture-online/>



**Tricia James, NCPST  
Secretary**

### Graduants 2009 & 2010

- \* **Taghrid Abu Shemalah, MSc**  
*School of Physical Sciences*
- \* **Tuty Asama Abu Bakar, PhD**  
*School of Mechanical & Manufacturing Engineering*
- \* **Mahua Biswas, PhD**  
*School of Physical Sciences*
- \* **John Dardis, PhD,**  
*School of Physical Sciences*
- \* **Samantha Fahy, MBA**  
*NCPST Operations Manager*
- \* **Niall Fitzgerald, PhD,**  
*School of Physical Sciences*
- \* **Shahriar Hasan, MEng,**  
*School of Electronic Engineering*
- \* **Diana Garcia Alonso Garcia, PhD,**  
*School of Mechanical & Manufacturing Engineering*
- \* **Alan Meaney, PhD**  
*School of Physical Sciences*

## Tricia James

I am currently working as a Secretary with the NCPST. Prior to this I worked for the BDI and the OSL. I started working for the Centre in 2008, initially to cover maternity leave. In May 2009 I was offered a new position as the Secretary to the new SFI Research Cluster Project, Precision.

A typical working day for me involves a variety of tasks. This can include anything from taking care of students and Pls, for example, making travel arrangements for conferences and workshops, to updating

financial accounts for the Precision Pl's and Associated Dean of Research. I'm also involved in organising and attending a range of meetings within the centre, placing orders for the researchers and updating the website.

It's a busy and demanding role and I like the challenge. I have a great network of colleagues who really make working at DCU enjoyable. I also have good relationships with the researchers and students, which also makes my role at the NCPST rewarding and fulfilling.

Outside of work, I'm studying for a BA in Personal and Professional Development with a focus area in Business Studies at All Hollow's College. This new BA programme allows you to tailor courses around your subjects of interest and your personal and professional circumstances. The other areas I've opted to study are Arts and Ideas which looks at the creative and reflective aspects of life, Human Development which addresses cultural topics and Adult Learning which covers critical thinking, research and communication.

## Research Funding Updates

The NCPST has been very successful in attracting research funding in recent times, particularly national funding. The biggest grant has been over €4 Million for the PRECISION Strategic Research Cluster in 2009, which is supported by SFI and several industrial partners. The Cluster is hosted by the NCPST and RINCE at DCU and the Surface Engineering Group at UCD and aims to develop the knowledge needed for present and future manufacturing applications using plasmas. On semiconductor research the Centre is also currently participating in the European ENIAC project IMPROVE, which aims to enhance European semiconductor fabs efficiency by providing methods and tools to better control the process variability, reduce the cycle time and enhance the effectiveness of the production equipment.

We are branching out into new applications of plasma technology with some interesting awards – the Energy Lab has received Enterprise Ireland funding to develop a new eco-friendly tumble dryer (the 'EcoDryer'), and is collaborating with industry to investigate remote monitoring & control of Renewable Energy Installations.

We are also looking at medical applications of plasma technology and this summer, the Centre was part of a successful bid for PRTL Cycle V funding to establish a new Nanobio Analytical Research Facility at DCU with a primary focus on Translational Nano-medicine.

In the coming months we are applying for funding to set up a joint research programme on fusion related technologies with the Institute for Plasma Research in India and another with the Australian National University.

There are a number of upcoming European FP7 funding calls which may be of interest to NCPST members, in particular Marie Curie grants and several NMP and ICT calls. A European Research Council Advanced Investigator Grant call is also currently open. If you want any help in putting together and submitting a funding proposal contact Claire: [claire.mckenna@dcu.ie](mailto:claire.mckenna@dcu.ie)



**Claire McKenna  
Research Officer**

## Focus on

# The Energy Lab



The Energy & Design Lab in the National Centre for Plasma Science & Technology and School of Electronic Engineering DCU is a relatively new addition to the University's research interests. The lab is headed by Stephen Daniels.

One of the goals is for the lab to engage directly with industry to develop solutions based on focused research and commercial know-how. So far, the main area of focus has been on sustainability in terms of energy monitoring, awareness and conservation. The lab is working with power solutions company, Cinergy Ltd. This company provides renewable and hybrid power sources to telecoms companies both nationally and internationally. One of their products uses a monopole structure which contains all of the operators' transmission equipment and utilises a wind turbine on the top of the structure. This setup allows operators to quickly deploy a transmission site and use the power generated by the wind turbine to offset their power consumption on sites connected to the grid.

The lab also works with local schools to create an energy consumption awareness and demonstrations of alternative energy sources, some examples are:

**Hydrogen Powered Cars:** The Energy Lab assisted groups of primary school children to build their own small hydrogen

powered cars. This allowed them to learn the process of producing hydrogen and then utilizing that hydrogen to power their cars.

**Power Generating Bike:** The bike is connected to monitoring equipment which indicates how long it would be able to power common household equipment based on the amount of energy generated in a 30 second cycling session. Students then get to appreciate the level of power required to power items such as their XBOX 360, if only for a few seconds in some cases!

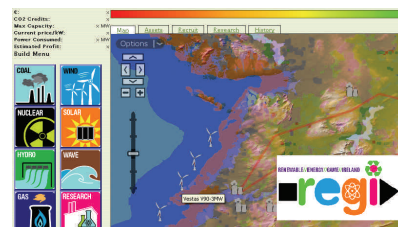
**Energy Simulation Game (Fig 1):** A prototype energy simulation game is being developed. Using a point based awards system; users will be encouraged to find alternatives sources of energy to supply the needs of the country. It would demonstrate the advantages or disadvantages of renewable energy and traditional energy sources. It is intended that this game could be used as an educational tool in primary and secondary schools to help inform children about how the energy industry works and the effort required to build a sustainable energy network.

A model environment is also under construction to simulate energy usage in the home. This will demonstrate the power consumption of appliances based on

their size, type and energy rating if applicable. Once the model has been constructed, a physical representation of household appliances will be built to verify the accuracy of the software based model. Over time the physical system will be monitored with potential areas of energy conservation identified

Mr Shane Phelan/Dr Stephen Daniels ([stephen.daniels@dcu.ie](mailto:stephen.daniels@dcu.ie))

<http://energylab.eeng.dcu.ie/energylab/> and



[www.ncpst.ie](http://www.ncpst.ie)

Fig1: (REGI - Renewable Energy Game Ireland)

## LEL off to a flying start and looking for speakers

**There was a big turnout for the first LEL meeting last semester. The seminar series which is open to students, post docs and lecturers started off its second year with the usual mix of fun and physics. Over 20 people attended 'The Great Paper Plane' competition which tested manual dexterity and astrophysics know-how. The winners were Jack Connolly, Catherine Doyle and Rob O'Connor.**

A dread of public speaking led postgrad, Ruth Saunders to set up the lunches last year. "As a scientist you have to present your work in public, either at conferences or seminars. This is a stress-free way of practicing your public speaking skills and getting to talk about your work with other researchers and lecturers," says Ruth.

Anyone can present and a good crowd attended Professor Eugene Kennedy's talk last November. As always, the speaker has to bring some homemade baking (although it's not always the speaker's own work!). In fact, the only thing that gets judged at LEL is the quality of the baking and the standard is very high, according to Ruth. Dr Tony Cafolla won the competition last spring with an old family recipe. The NCPST also provides tea and biscuits.

Between 20 and 60 people took time out to support each other and listen to a different topic every week last year. This year, however, the meetings will take place every second week and the LEL is looking for more speakers and attendees. Meetings are held in Room N115 at 1pm in the School of Physical Sciences.

Contact Ruth Saunders ([ruth.saunders3@mail.dcu.ie](mailto:ruth.saunders3@mail.dcu.ie)) if you're interested in giving a talk.

*"The talks can be about anything, the quirkier the better. Some of the most popular talks last year were on the physics of superheroes and when Scifi movies get it wrong"*

## Professor John Costello



John Costello is Associate Dean for Research in the Faculty of Science & Health and a member of the School of Physical Sciences. He obtained his Ph.D. (1986) from University College Dublin in laser plasma spectroscopy under the direction of Prof. P. Kevin Carroll. He is a Fellow of the Institute of Physics, a Chartered Physicist and a member of the European Physical Society. He was one of the founding members of the NCPST and continues to be a strong supporter of the continuation of the original HEA PRTL I Phase I & III National Centres as integral parts of the DCU research structure.

John has also served as Head of School of Physical Sciences from 2004 – 2009 and acted, in that capacity, as Chair of the Euratom Fusion Development Association contract for Ireland. His research interests lie mainly in intense laser matter interaction and in particular, photoionisation processes. However, if he was starting a career in research now he'd choose the domains of ultrafast laser matter interactions or (at the other end of the temperature scale) atomic Bose-Einstein Condensates (BEC) as "if you want to learn new things in physics, you have to go to the extreme, beyond known parameter spaces".

He is the corresponding author of an invited review on X-ray lasers for the *Journal of Modern Optics* (Vol 57, pp1015-1040, 2010). He in turn invited most of the global

leaders in this space to contribute and co-author a paper. It focuses on the fundamentals of X-ray free electron lasers (FELs) and the interaction of X-ray lasers with atoms and molecules to form photoionised plasmas. Right now there are only three X-ray FEL facilities operational worldwide – Japan (SCSS at Hyogo), the US (LCLS at Stanford) and Germany (FLASH at DESY-Hamburg) but a number of others, such as FERMI in Trieste are on the way. According to John, success in accessing these facilities is primarily due to forming strategic collaborations. "Our unique competitive point is building strong international collaborations with local experts who have complimentary expertise, such as with the team at DESY-Hamburg and the Stanford Linear Accelerator (SLAC) and top fundamental physics groups at Max Planck in Garching, Orsay and Ohio State." Although this type of relationship takes time to build, it is time well spent as it has given him and colleagues here competitive advantage in gaining access to highly-sought after beam time. In 2011 the group will travel to FLASH-DESY twice (spring and summer) and LCLS-Stanford in the autumn.

Another current area of research is colliding plasmas. John recently co-authored a paper with a graduate student John Dardis on this topic entitled 'Stagnation layers at the collision front between two laser-induced plasmas' for *Spectrochimica Acta Part B: Atomic Spectroscopy* (Vol65, pp627-635, 2010). This field could lead to new scientific and engineering platforms and it has potential applications in

high flux X-ray light sources, new plasma deposition methodologies and potential for laboratory astrophysics. "We're currently using it to develop a potential light source solution for next generation lithography in partnership with UCD, Trinity and industry".

However, while applications are an important aspect of scientific research, he is an advocate of the necessity for universities to continue promoting fundamental research, arguing, "if universities don't do basic research, who will? We need activity along the entire pipeline from basic and fundamental research through to applications and commercialisation."

"We're in a different phase of science as a socio-economic activity compared to forty years ago." For example, he points out that the needs of industry and the pace of innovation in universities have converged in recent times and that this creates both huge opportunities and challenges for science and scientists. High tech industry is moving into nano-space and femto-time and this means modern physics becomes even more relevant – industry will no longer be able to rely on tried and trusted classical physics 'truisms'.

As part of this challenge, John believes that industry and universities will have to work more closely. Fortunately, he also believes the relationship between industry and science research is improving. "Timelines are

becoming more realistic and industry is beginning to recognise that lots of ideas need to be tried out simultaneously."

Scientific research also faces economic challenges and that this is where international collaboration is vital. "We can't do it all locally, we need international collaborations and many experienced people tackling the same problems.", he says.

Recognition of the value of strategic collaboration is part of the thinking underlying the work he puts into regularly updating his webpage. John sees communication, particularly on an international level, as an essential component of creating good science. "As well as offering a broad view of the discipline, the webpage is useful for finding prospective Ph.Ds and postdocs. It's a profile of the group and it informs a community of where you are and what you're doing'. The webpage is also a useful for the business of science. "Networking and strategic communications are essential in many areas of scientific activity, from the creation of ideas, through all the research stages to execution and commercialisation of applications as well as for funding".

It is important to develop critical mass research groups and he advocates that 'there needs to be at least two or three research leaders to each thematic area'.

<http://www.physics.dcu.ie/~jtc/>



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### Conferences/Workshops for 2010/2011

**2nd Workshop on Biomedical Applications (2011)**

**Irish Plasma Beam & Processing Group (May 2011)**

**Workshop on Radio Frequency Discharges (2011)**

**Workshop on AMO Processes in Intense UV & X Ray Laser Fields (21—23 July 2011)** <http://www.physics.dcu.ie/~I-SWAMP/>