IOP | Institute of Physics
London and South East Branch

Online Newsletter **October 2012** **Issue no 22**

Innovation for Treasurers

After the Branch Treasurers' meeting on 3rd October IOP had arranged a visit to view the stands of the Innovation Award winners during the afternoon of the 3rd October. The Awards were presented later at a dinner on 3 October. Representatives of four companies each accepted an IOP Innovation Award, a newly established category of award that recognises and celebrates companies that have achieved significant commercial success by developing and deploying physics-based innovations. The winners were: - Aurox Ltd, Naneum Ltd, The Technology Partnership plc and ZBD Displays Ltd.

At the afternoon Meeting IOP president Professor Sir Peter Knight introduces some of the innovation Winners.

Also visiting the four innovation displays were ; -

(left) Professor Averil Macdonald

and

(right) IOP Chief Executive Professor Paul Hardaker.

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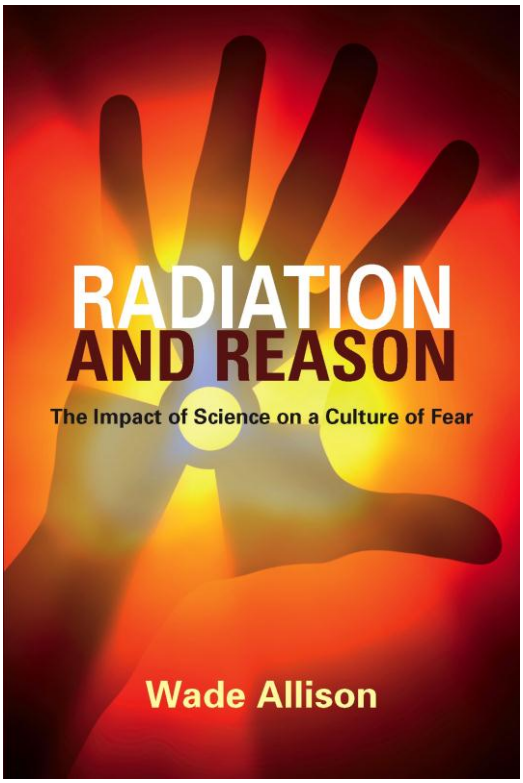
Innovation Awards Afternoon: (Right Picture) A Technology Partnership plc micro device for drug delivery.

The ZDB display highlighted a set of fully graphic electronic shelf labels and associated software for the retail industry. No battery power is required to maintain the display. Aurex was displaying an affordable attachment to a conventional microscope that enables high quality 3D images to be acquired in real time. Naneum Ltd presented an easily portable device to measure particle size distribution over a range of 5nm to 500nm suitable for aerosol science and indoor/outdoor air quality to name just two applications. As shown above the Technology Partnership were exhibiting devices using an nano pump, the right hand picture shows a nebuliser for asthma patients.



Radiation and Reason: a fresh look at the effect of radiation on life.

Professor Wade Allison, Oxford University, presented his Radiation and Reason talk to the Branch at the Institute of Physics on 17th October 2012.

There is a widespread belief that nuclear energy is inexorably dangerous, and this phobic attitude stems from the events leading to the nuclear bombings on Hiroshima and Nagasaki in 1945 and the Cold War era. The fear of an imminent annihilating holocaust has been present in the human mind ever since and accidental events at nuclear plants at Chernobyl and more recently, Fukushima, have corroborated this. The panic not only affects lay persons but extends to governmental institutions, which the media use as a fertile ground to instil more fear. But is radiation such a deadly influence that has to be avoided at all costs? Are these fears based and justified on solid empirical data?

Everything is made of atoms. Atoms have a nucleus, 100,000 smaller than the atom, heavy, electrically charged, stable and unchanged. Only 1 nucleus in a million has changed since the formation of the earth 6,000 years ago. This change is denominated radioactive decay. **Continued page 3**

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Every nucleus remains completely isolated because of its small size and by the intense repulsive force of its electric charge. There exists natural radioactivity within the Earth since its formation, and this radioactivity and heat that contributes to earthquakes, volcanoes and tsunamis.

On March 11 2011 a magnitude-9 earthquake struck the northwest coast of Japan and generated a tsunami that completely devastated a wide coastal area. This resulted in significant loss of life ->20,000 persons died- and socio economical loss.

Neutrons exist only inside a nuclear reactor that is 'on' at the time or inside a nuclear weapon at the moment of explosion. As soon as the earthquake was detected, all nuclear reactors were switched off and the neutrons were absorbed. By the time the tsunami struck there was only radioactive decay in the reactors. This generated immense heat that was damaging, in the absence of sufficient cooling water to keep both the temperature and pressure down. At high temperature, the nuclear fuel containers made of zirconium reacted with water, releasing hydrogen. This exploded when outside, but these explosions were no worse than the destructive fires. So the damage here was chemical, not nuclear.

Interestingly, radiation exists ubiquitously in nature and is successfully used in medicine for the treatment of malignancies. The average monthly dose received from natural sources is ~0.2 mSv. A CT scan dose is 5-10mSv. PET and SPECT scans are also within that range and these dosages are innocuous unless the number exceeds of >10 monthly.

In radiotherapy, dosages of >50,000Sv are given to tumours, spread over several weekly treatments, and despite some protection, peripheral non-carcinogenic tissues also receive some radiation, but they withstand it. At Chernobyl, 27 of the 42 the fire-fighters receiving doses above 4,000mSv died in a few weeks whereas none of the 140 died with a dose below 2,000mSv. There were some cases of child thyroid cancer from radioactive iodine, the majority of them treatable. The effects of radiation on the body affect the double stranded DNA molecule. The DNA can repair itself. But oxygen radicals also damage the DNA molecule. The radiation damage can be acute (Acute Radiation Syndrome) or more prolonged.

There have been no radiation-related casualties at Fukushima yet and the chances of occurring are remote. The more devastating blows in the region have been economic, social and psychological.

In summary Professor Wade Allison regards nuclear energy as safe, affordable and in the long run, effective and more economical. There are risks posed to humankind and the planet, but these are originating from: CO_2 waste from fossil fuels, biological waste, climate change, financial crises and other economic concerns. New safety levels for human radiation exposure are suggested: 100 millisievert in a single dose, 100 mSv in total in any month; 5,000 mSv as a total of whole-of-life exposure. Education, information and general understanding will play an important and decisive role in demystifying the nuclear phobia that currently afflicts our society.

Dr N M Calvo

Branch Dinner

21 November 2012

Reserve List now in operation.

As of 30 October 2012

If you wish to be placed on the reserve list please email the branch treasurer.

This online newsletter has been produced

by

The London & South East Branch IOP

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STRANGE MATERIALS.

On the 2nd October branch members in the Kent area had a lecture by Professor Mark Miodownik from the Department of Materials, University College London entitled STRANGE MATERIALS. In 2010 Professor Miodownik gave the Royal Institution Christmas Lectures and he contributes regularly to television and radio programmes.

His talk began by reviewing the the historical development of the technology of glass production. He then discussed the current technology being developed to produce artificial body parts and that associated with 'self-sealing' concrete that automatically repairs any crack that occur. These developments, he suggested, could lead to the next technological revolution in which we have an extended life span.

Dr C Isenberg

Professor Mark Miodownik (left) and Dr Cyril Isenberg.

Theoretical Physics and String Theory

Left to right, Dr Cyril Isenberg, University of Kent, Dr David Berman, Queen Mary, University of London, and Dr Lewis Ryder, University of Kent.

The ' Theoretical Physics and String Theory ' lecture by Dr David Berman from Queen Mary University of London, on 23 October at the University of Kent, attracted a record audience from sixth formers to professors. David Berman gave an inspiring lecture that gave rise to a wide diversity of questions and left everyone wondering if, post- Higgs, this is the next 'particle physics mission' that will lead to a grand unified theory.

Dr C Isenberg