

Physics & Astronomy

FROM THE HOD (ASSOCIATE PROFESSOR ROGER REEVES)

A few events this week to relate to the Department. On Wednesday there was an Academic Board Meeting with the main business concerning the University Profile and discussion about the C- grade.

The new TEC funding regime requires "investment plans" drawn up as agreements between TEC and the institution. Each institution has an investment manager from TEC who is to lead these negotiations and is thus ultimately responsible for providing the ~\$150m to this university. TEC is in a real muddle over this structure - not the least because of the inexperience of the investment managers it has appointed. I believe the UC manager is rather young - still to finish graduate school. Hopefully we shouldn't be worried as we all know what a fine organisation TEC is. In the information vacuum that exists UC is taking the approach of developing a Profile. Its submission is required by Sept 30 and it will form the basis to which we get access to govt funds for the next 3 years.

The C- grade which we do use in this department came under scrutiny. The questions were whether it actually represents a pass or a fail. Clearly it is a pass because the students are credited with the points. It has been referred back to the Academic Committee to look at, particularly in relation to the number of such grades a student can obtain in their degree.

On Wednesday evening I went to the opening of the Blue Fern supercomputer. Michael Cullen was there to launch the machine. In his speech there were the usual comments about knowledge economies, high tech initiatives etc. I wish I had a dollar for every time I heard the phrase "knowledge economy".

Prof Tim David of Mech Eng is the main push behind this purchase and he gave a short overview of some research projects that will benefit. Our own Steve George got a plug for his modelling of the ozone hole. The MacDiarmid Institute has given \$700k of capital towards Blue Fern's purchase. Simon Brown's collaborations with Sean Hendy (Vic) will take advantage of the extra processing power now available. For the technically minded, Blue Fern has 65,000 processing nodes, each containing multiple CPU's. This is compared with 128 in the existing P-series "supercomputer" that was bought last year.

Blue Fern can operate at 360 Teraflops. Only 25 academic institutions in the world operate this technology.

Last night we had an information evening for the 300-level students. I think it went very well - but its always hard to judge. In discussions afterwards there was quite a bit of interest in PHYS390 as a gateway to research for our students. Many thanks to those graduate students who came along and helped out.

THIS WEEK'S SEMINAR: - 11:00AM, FRIDAY 17 AUGUST

Dr Clemency Montelle

Dept of Mathematics, University of Canterbury

Crossing the Shadow, Theoretical Techniques for Eclipse Prediction in the Ancient World

In all cultures in the ancient world that took an interest in the heavens, eclipses were events of great significance. However, out of all celestial phenomena, they presented the astronomer with the most challenges. Problems that were easy to formulate such as frequency, duration, and amount of obscuration, rested upon more advanced astronomical and mathematical theories than were available: such as spherical trigonometry, parallax, and the measurement of time, to name a few.

This talk will discuss a selection of observation reports and predictions of eclipse times by early astronomers and explore some early attempts to develop and improve theoretical techniques to model eclipse phenomena, particularly those that emerged in the Ancient Near East and India.

NEXT WEEK'S SEMINAR – 11:00AM, FRIDAY 24 AUGUST

Dr Anthony Butler

Consulting Radiologist at the Christchurch Hospital, former University of Canterbury student of the Physics and Astronomy Dept and PhD student of the Electrical Computing Engineering Dept

Bio-medical X-ray Imaging With Spectroscopic Pixel Detectors

The aim of this presentation is to review the clinical potential of spectroscopic X-ray detectors. Images of surgical specimens obtained with a Medipix-2 detector will be presented. A new breed of X-ray detectors is being developed that individually processes photons interacting with a sensor. These are either known as quantum detectors, photon counting detectors, or for the more advanced systems, photon processing detectors. Many of these detectors, such as Medipix-2, allow thresholds to be selected so that only photons within a specified energy range are recorded. New detectors in development, such as Medipix-3, have multiple thresholds within each pixel. These new detectors will allow for routine use of spectroscopic X-ray systems for bio-medical imaging. The significance of spectroscopic X-ray detectors is difficult to predict but insights can be gained by examining both image reconstruction artefacts caused by beam hardening, and the current uses of dual energy techniques in biomedical imaging. Beam hardening artefact is a CT reconstruction artefact that arises due to the approximation that the spectrum of transmitted X-rays is constant regardless of the material being imaged. This artefact poses significant clinical problems in diverse areas including CT pulmonary angiography and musculoskeletal imaging around metallic implants. It is hoped that with spectroscopic detectors the artefact can be reduced, thus improving diagnostic capabilities. Dual energy angiography is a technique where an infused angiographic contrast agent is identified by its k-edge. Within bio-medical imaging iodine and gadolinium contrast are routinely used for vascular studies and tumour characterisation. Both iodine and gadolinium have k-edges within the energy range of diagnostic X-rays making them easily identifiable with spectroscopic detectors. Potential clinical applications include pre- and post-contrast CT imaging and retention of contrast in tumours such as breast cancer. Different tissues and tumours have different attenuation coefficients over a range of energies. Spectral imaging will translate to better identification and delineation of tumours compared to conventional imaging. While dual energy techniques are well established for bone diseases, for practical reasons they are rarely used elsewhere.

Despite this, spectral information is known to be of benefit for many diseases. Published examples of the use of energy information in mammography include:

- 1) lower energies provide better soft tissue contrast.
- 2) ductal carcinoma has a different attenuation spectrum than fibrous tissue.
- 3) micro-calcification can be better identified for early detection of cancer.

In conclusion, spectroscopic X-ray pixel detectors have potential for a wide range of clinical benefits.

PHYSICS & ASTRONOMY DEPARTMENT CONFERENCE (MICHAEL ALBROW)

This year the Department Conference will be held on **Monday 3 and Tuesday 4 September** in Maths 031. This is a great opportunity for students and staff to give presentations on their research and to find out exactly what is going on in the various groups in the Department.

All thesis students will give a 10 minute presentation on their research, with 5 minutes for questions. Students who are away at the time of the conference will give presentations later in the year, possibly in a Friday seminar slot.

Titles and abstracts should be emailed to Rhonda before 21 August. Abstracts should be about 1 paragraph in length.

WHAT YOU ALWAYS WANTED TO KNOW – BUT WERE TOO AFRAID TO ASK

There was much discussion in the 2nd Floor tea room yesterday regarding the glide ratio of a 747....and after some research in google and from pilot forums - Graeme MacDonald reports that depending on the version of 747 and the wing loading , the answer is between 15:1 and 19:1.

WINTER SCHOOL IN ASTROPHYSICS AND SUPERCOMPUTING AT SWINBURNE HAMISH SILVERWOOD (& DAVID JOLLY)

On arriving at the comically named California Hotel I found out that I was extremely lucky. I'd left Christchurch at 4pm, arrived in Melbourne at 5pm local time, and after an hour long taxi ride through the central city was able to collapse, exhausted, on a bed. This was in stark contrast to my colleague, fellow third year physics student David Jolly.

Although he left Christchurch a full 12 hours ahead of me, he had only touched down in Melbourne a few hours before I did, having encountered heavy fog in Sydney and suffering the subsequent backlog. He and his fellow passengers no doubt became intimately familiar with the airspace over Canberra.

The next day we wandered down to the Swinburne University of Technology, for the opening of the Winter School in Astrophysics and Supercomputing.

Over the next two and half days we were given a series of lectures on the research being conducted at Swinburne's Centre for Astrophysics and Supercomputing, taken on a tour of their facilities and shown several movies in their 3D theatre. The 3D theatre was one of the highlights of the Winter School; using polarized light instead of red and blue light, the 3D images appear to be much more 'real' and were in full colour, though one still needs to wear a set of funny glasses.

The supercomputing part of their name currently takes the form of the recently installed, energy-efficient 'Green Machine', which consists of

145 Dell Power Edge 1950 nodes. The supercomputer is used for numerical simulations, data processing, and also the rendering of their 3D movies.

Although UC's soon to be installed 'Blue Fern' supercomputer will outperform their Green Machine our dominance probably won't last long - the Australian government will soon be giving Swinburne \$4m to upgrade their current machine or buy a new one.

Overall the Winter School was a very enjoyable trip, though I would recommend to future attendees to find a Melbourne native if you want to hit the town - doing circuits of the CBD in the pouring rain is definitely not the best way to find a good bar.

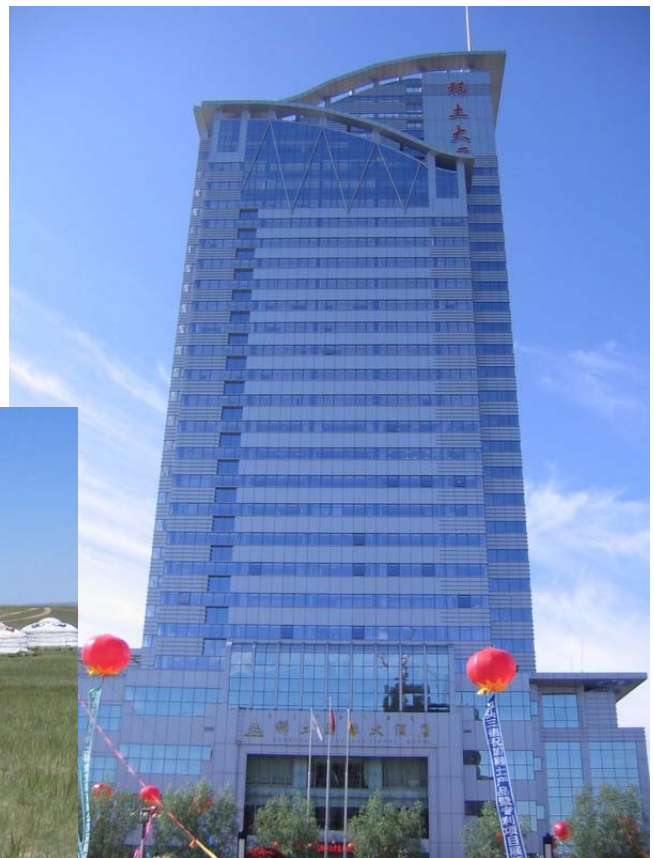


RARE EARTHS IN BAOTOU (MIKE REID)

Last week I went to a conference in Baotou, Inner Mongolia with Chang-Kui Duan and one of the PhD students from here at City University. Baotou is about an hour west of Beijing, which is 3 hours north of Hong Kong, though to save money we flew from Shenzhen, the Special Economic Zone to the north of Hong Kong.

Baotou might be in the middle of nowhere, but it is the heart of world rare earth industry, with the largest mine nearby. The original plan was for us to be able to visit the mine during the conference, but there was some sort of problem (possibly political) so that was cancelled. This was a little upsetting for the Canadian Geologist who came to the conference mostly because of the mine visit.

Baotou is not very large, a couple of million people. It has been completely rebuilt over the last 10 years or so and we stayed at the "Rare Earth Hotel" which is in the Rare Earth area of the city. There are other areas that contain different industries. You can see the hotel and some of the city in the photographs. The city is full of



very pleasant.

tree-lined avenues and parks, and is

The conference had a heavy industrial focus, and there was an associated industry exhibition, aimed mostly at the Chinese participants (there being only a few dozen foreigners). China now dominates the rare earth market, though recently rising prices, particularly for neodymium (used in the magnets in disk drives, etc) mean that it is now economical for some of the western mines that have been inactive to re-open. The spectroscopy sessions were dominated by phosphor research, particularly for lighting, both UV and LED-driven. Progress in China in such areas in the last 20 years is phenomenal, and the development work here is now world class.

Since we were unable to visit the mine, we were taken on a tour to the grasslands. Unfortunately, this involved 4 hours in a bus, three hours at the grasslands, and another four hours on a bus, but it was nice to see the Yurts out there (see photo) and to imagine Genghis Khan's troops riding off on those funny little horses to conquer much of Asia and Europe. After the conference we spent a night at the edge of the Gobi desert, at a theme park where you can ride camels, slide down the dunes, and generally have fun. There is obviously a huge domestic tourist market (I only saw two foreigners there among thousands of Chinese)

and the Mongolian culture is a draw card, though mostly it's Han Chinese dressed in Mongolian costumes at the cultural shows. This year is the 60th anniversary of the Mongolia Autonomous Region (set up before the end of the war with the Kuomintang in 1949), so the city was particularly decorated for the occasion.

GRADUATE PROFILE SEGMENT...

Whilst searching out graduate profiles from past students from our department we have come across some graduate profiles that the editor thought would make interesting reading for our department newsletter. We hope to use these profiles in site to give prospective students some ideas of where their qualifications could lead...

(If you know of other graduates – that we could mention in this segment – please email me with names, to rosalie.reilly@canterbury.ac.nz)

COMBINING A BSc(HONS) DEGREE IN PHYSICS WITH HER OVERSEAS EXPERIENCE LEADS TO A REWARDING CAREER BACK IN THE NZ ENERGY INDUSTRY FOR EMI PIUILA-AFITU .. IN HER OWN WORDS...

Six months after finishing an Honours Degree in Physics at Canterbury, I moved over to the UK for my big OE. At the time you weren't allowed to work in the area you'd trained in with a Working Holiday Visa, so I worked as a secretary and PA. Having a First Class Honours Degree really opens a lot of doors over there, especially as everyone has Honours, so anything to distinguish yourself from the rest is useful. Being able to say it's in Physics also seems to impress people!

After about 18 months I saw a great job advertised in New Scientist for an Optical Radiation scientist at the UK's National Standards Lab, the National Physical Laboratory (NPL). Thanks largely to the high quality of my degree and subsequent ability to answer difficult questions about optical radiation during the interview, I secured the position and could prove that I was the best choice in the European Union (that's a work permit condition – and easier to do than it sounds!) My former honours supervisor and referee was also now a lecturer at Oxford which helped too!

Whilst at NPL:

- Started in calibration work in Optical Radiation – mostly spectroradiometry and photometry
- R&D in the Acoustics department on the Laser Pistonphone which measures microphones at low frequencies of 1 – 150Hz
- Ionising Radiation
- Moved to Knowledge Transfer and the business side of science
- Deputy UK National Contact Point for European Framework 6 Funding in Information Society Technologies
- Finally, formulation of the Material and Thermal departments' programmes – working on the interface between industry, scientists and government (UK Department of Trade and Industry)

I moved back to NZ in Dec 2006 after six and a half years in the UK, four and a half of which I spent working at NPL.

I now work for the Industry Capability Network (ICN) as an Advisor in the Energy Sector. ICN is a business unit within NZ Trade & Enterprise (NZTE). Whereas most of NZTE looks to get NZ business exporting and looks overseas, the ICN looks internally and tries to get more NZ businesses working on large projects that are NZ-based. For example, I work with the big energy SOEs to get more NZ companies bidding and working on their contracts.

I couldn't have gotten this job without knowledge of the energy industry, the ability to understand technical documents/specifications and good work experience. My Physics degree from Canterbury University gave me a great base to gain exciting work opportunities in the UK and now in NZ.

AUGUST 2007 SCHOLARSHIPS – WEB SITE

View General Scholarships at:-

<http://www.canterbury.ac.nz/scholarships/resources/currentnoticeboard.shtml>

College of Science Scholarship

<http://www.canterbury.ac.nz/scholarships/noticeboard/august2007sci.shtml>

NEWS FROM THE PHYSICAL SCIENCE LIBRARY

(1) SciFi update

Just when you thought you had everything you needed... We now have access to The Oxford Dictionary of Science Fiction. Available via the Library catalogue or access direct... <http://tinyurl.com/26fk4n>. More on our SciFi collection - <http://library.canterbury.ac.nz/psl/scifi.shtml>

(2) National Library online Science exhibits

<http://tinyurl.com/2443g9>

(3) Hot Science with Kim Hill

Miss the public seminars? Listen to the podcasts -

http://www.bigpod.co.nz/Default.aspx?tms_id=116&tabid=56

(4) Hate paint fumes? Avoid Level 3 of the Central Library at the moment..

<http://library.canterbury.ac.nz/news/index.shtml>

Adam - <http://library.canterbury.ac.nz/people/cath.shtml>

If you have anything you would like to contribute to the Newsletter, please email Ro on rosalie.reilly@canterbury.ac.nz:
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