

Physics & Astronomy

FROM THE HOD (ASSOCIATE PROFESSOR ROGER REEVES)

I'm sure it has become widespread news about the passing of Prof Alan MacDiarmid recently in the USA. I have met Alan several times through our respective roles in the MacDiarmid Institute, most recently in Korea when we attended a small conference of worldwide MacDiarmid Institutes. His enthusiasm for science and willingness to promote communication and goodwill was unbounded. Most recently his passion extended to the world's energy problems and he was a strong advocate for bio-sources of energy. Next week at the AMN-3 conference we have a wonderful opportunity to celebrate his life.

Yesterday I attended my first CoSEx meeting as HoD. Of particular interest among the items discussed was some details on the future of tertiary funding and the move away from total EFTS based funding. The new system will see university's develop distinctive profiles that will differentiate them from others. I'm sure it will provoke thinking here as to what is distinctive about Canterbury.

Next week I am away at the AMN conference in Wellington. Peter Cottrell returns on Monday and will be acting HoD during this time.

THIS WEEK'S SEMINAR: - 11:00AM, FRIDAY 9 FEBRUARY

No scheduled seminar this week.

NEXT WEEKS SEMINAR: - 11:00AM, FRIDAY 16 FEBRUARY

Dr Sylvie Vauclair

Observatoire de Paris-Meudon, France

Asteroseismology of exoplanets hosts stars

Asteroseismology recently became a powerful tool for testing the internal structure of solar-type stars. Meanwhile, more than 200 exoplanets have now been discovered, a number large enough to allow for statistics.

Comparisons between exoplanets hosts stars and stars without detected planets give evidences for some differences between them. In particular exoplanets hosts stars are over metallic compared to the Sun by a factor about two. I will give a general summary of these questions, and I will present the first asteroseismic analyses and results we obtained for exoplanets hosts stars.

UP AND COMING SEMINAR: - 11:00AM MONDAY 19 FEBRUARY

J. Akola

Nanoscience Center, University of Jyväskylä, Finland

Gold Atoms and Clusters on Defected Graphite (0001) by

Density Functional Theory

Possible ways for attaching gold atoms and clusters ($N=6$) on defected graphite (0001) have been studied using the density functional theory, a generalized gradient correction for the exchange-correlation energy, pseudo potentials and periodic boundary conditions [1]. Apart from pristine graphite (0001), three types of surface defects have been considered: a surface vacancy (hole), a pyridine-like defect comprising three grouped nitrogen atoms, and a direct replacement of C atom with either N or B. Results for both Au and Au₆ imply that the surface vacancy is able to form chemical bonds with Au as the three nearby carbons

align their dangling bonds towards the gold particle (binding energy 2.4-2.6 eV). A similar hole-like construction with three pyridinic N atoms results in a significant polarization (1.1-1.2 eV), whereas binding with faultless graphite is weak (0.3-0.5 eV). Several Au₆ isomers in different orientations are tested on substrate, and coordination through corner atoms is found energetically favourable. Analysis of the charge density shows no considerable charge transfer, and the net charge on Au₆ ranges between -0.1e and +0.2e. The detailed charge accumulation/depletion plots reveal interesting polarization effects between Au₆ and substrate [2].

In addition, I shall discuss the properties of alkali metal (Li, Na, K, Rb, and Cs) atoms, clusters and (2x2) monolayers on graphite. The adatoms are observed to bind at the hollow site (graphite hexagon), with Li lying closest to (1.84 Å) and Cs farthest (3.75 Å) from the surface. The adsorption energies range between 0.55 and 1.21 eV, and the energy ordering of the alkali-metal adatoms is Li > Cs ≅ Rb ≅ K > Na. The formation (cohesion) energies of (2x2) monolayers range between 0.55 and 0.81 eV, where K has the largest value, and increased coverage weakens the adsorbate-substrate interaction (decoupling) while a two-dimensional metallic film is formed. Analysis of the charge density redistribution upon adsorption shows that the alkali-metal adatoms donate a charge of (0.4–0.5)e to graphite and the corresponding values for (2x2) monolayers are ~0.1e per atom. The transferred charge resides mostly in the π bands (atomic p_z orbitals) of the outermost graphene layer [3,4].

[1] CPMD V3.9 Copyright IBM Corp 1990-2005, Copyright MPI für Festkörperforschung Stuttgart 1997-2005. <http://www.cpmc.org>.

[2] J. Akola and H. Häkkinen, Phys. Rev. B **74**, 165404 (2006).

[3] K. Rytönen, J. Akola, M. Manninen, Phys. Rev. B **69**, 205404 (2004).

[4] K. Rytönen, J. Akola, M. Manninen Phys. Rev. B **75**, 075401 (2006).

SCIENCE PRESTIGE LECTURE:- 5:30 PM, C2 15 FEBRUARY

Marcus du Sautoy

Professor of Mathematics at the University of Oxford and Fellow of Wadham College

The Music of the Primes Thursday

Prime numbers are the hydrogen and oxygen of the world of numbers. Despite their fundamental importance to mathematics, they represent one of the most tantalising enigmas in the pursuit of human knowledge. Mathematics is the science of patterns. Yet the most fundamental numbers in the subject seem to have no patterns to them at all. They seem scattered randomly through the universe of numbers. But by looking at these numbers in a new way, mathematicians have discovered what they believe is the secret to the way Nature chose the primes.

VISITOR – NOELLE WALSH (SIMON BROWN)

A warm welcome to Noelle Walsh who is visiting with Simon Brown's group from 12th February to around 15th April. She comes to us from Professor Lutz Schweikhard's group at Ernst-Moritz-Arndt University, Greifswald.

PETER COTTRELL, ON CLAIRE WORLEY, LIZ WYLIE'S AND HIS AUSTRALIAN SOJOURN..

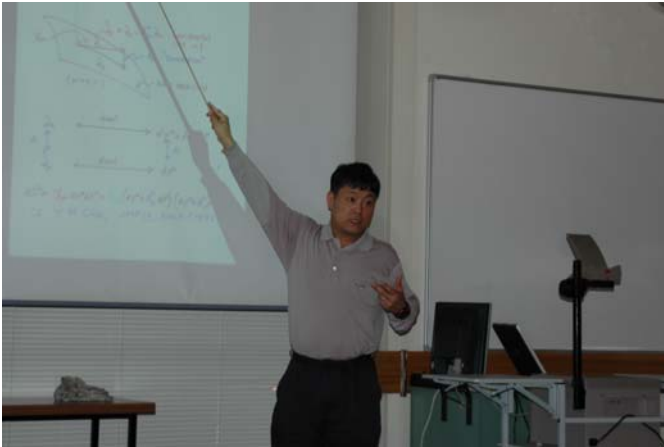
I'll be happy to be home as I can't handle the hot weather (30+ everyday and sometimes closer to 40C!!), the lack of water and living out of a suitcase for a month, not to mention the less than ideal Halls of Residence at Monash University! The research environment has been fantastic and I know that both Clare Worley and Liz Wylie have got heaps out of their respective visits (Clare to Monash for the SINS* Summer School, Swinburne and now Mt Stromlo Observatory; Liz to Monash for the SINS Summer School and also a lot of email traffic while Clare & I've been at Mt Stromlo).

Peter will update us more fully next week.

Update on the NEW ZEALAND / KOREA GRAVITY WORKSHOP 7-8 FEBRUARY 2007

A very interesting two days were spent by participants in our informal workshop, with at least half the talks given by students from Canterbury and Victoria, in addition to contributions from our Korean guests. It was remarked by our visitors that there was a wide range of talks, covering cosmology, string theory compactifications, categoric approaches to quantum gravity, quasilocal energy and angular

momentum in general relativity, definitions of black hole horizons, analogues of gravitational systems in Bose-Einstein condensates, formal aspects of general relativity, wormholes and perfect fluid solutions for stars. Considering our small size in New Zealand, we do indeed have diverse interests. Our Korean visitors also remarked that, given that jetlag is almost unnoticeable collaborations along the North-South longitude are a good idea, and they plan to come again in future. We hope that this will be the beginning of some productive collaborations.



Top left: Jong-Hyuk Yoon lecturing. Above: Marni Sheppard. Left: David Wiltshire with Sung-Won Kim

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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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