



## 2010 NOBEL PRIZE IN PHYSICS AWARDED

The School of Physics congratulates the 2010 Nobel Prize winners in Physics Professors Andre Geim (right) and Konstantin Novoselov (below). They have been awarded the prestigious prize by the Royal Swedish Academy of Sciences for their groundbreaking experiments regarding the two-dimensional material graphene, a thin flake of ordinary carbon - just one atom thick. Graphene is a form of carbon and Professors Andre Geim and Konstantin Novoselov have shown that carbon in such a flat form has exceptional properties that originate from the remarkable world of quantum physics.



As a material it is completely new – not only the thinnest ever but also the strongest. As a conductor of electricity it performs as well as copper. As a conductor of heat it outperforms all other known materials. It is almost completely transparent, yet so dense that not even helium, the smallest gas atom, can pass through it. Carbon, the basis of all known life on earth, has surprised us once again.

Geim, 51, and Novoselov, 36, extracted the graphene from a piece of graphite such as is found in ordinary pencils. Using regular sticky tape they managed to obtain a flake of carbon with a thickness of just one atom. This at a time when many believed it was impossible for such

thin crystalline materials to be stable.

However, with graphene, physicists can now study a new class of two-dimensional materials with unique properties. Graphene makes experiments possible that give new twists to the phenomena in quantum physics. Also a vast variety of practical applications now appear possible including the creation of new materials and the manufacture of innovative electronics. Graphene transistors are predicted to be substantially faster than today's silicon transistors and result in more efficient computers.

Since it is practically transparent and a good conductor, graphene is suitable for producing transparent touch screens, light panels, and maybe even solar cells. When mixed into plastics, graphene can turn them into conductors of electricity while making them more heat resistant and mechanically robust. This resilience can be utilised in new super strong materials, which are also thin, elastic and lightweight. In the future, satellites, airplanes, and cars could be manufactured out of the new composite materials. Both of Laureates originally studied and began their careers as physicists in Russia. Both are now professors at the University of Manchester.

Visit: [nobelprize.org/nobel\\_prizes/physics/laureates/2010/#](http://nobelprize.org/nobel_prizes/physics/laureates/2010/#)



## MUSIC & THE COSMOS ENCORE AT SHANGHAI EXPO

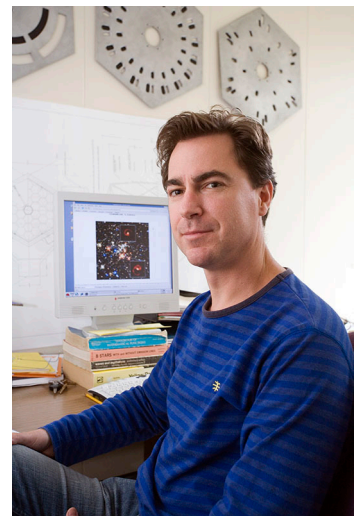
School of Physics astronomers, Professors Bryan Gaensler, Geraint Lewis and Peter Tuthill, who discovered *Red Square* above and is pictured at right, will take *Music and the Cosmos* to the international stage when they present this ever-popular encore event at the Shanghai Expo in China later this month.

Originally a concept born in Physics *Music and the Cosmos* received rave reviews to packed houses in 2007 at the Sydney Conservatorium of Music and in 2009 at the Great Hall.

In the 2010 performance the talented Mr Scott Kinmont will conduct both the Sydney Conservatorium of Music and Sydney Symphony Orchestras in their performance of Holst's *The Planets*.

Our astronomers will once more provide stunning imagery of our cosmic universe as a backdrop while the orchestras play and are sure to engage the audience with their lively and informative presentation on the cosmos - what we know and what we are hoping yet to discover.

If you would like to attend this international event to be held on Saturday 23 October from 3.00pm to 5:30pm at the InterContinental Shanghai Expo Hotel contact: Eve Simons T: +61 2 9036 9278 E: [alumni.rsvp@sydney.edu.au](mailto:alumni.rsvp@sydney.edu.au)



# SKAMP UPGRADED



The Sydney Institute for Astronomy (SIa) based within the University of Sydney's School of Physics, and CSIRO have collaborated in a project that will transform an existing university radio telescope into a world-class instrument. The University contracted CSIRO to assist in developing a signal-processing system to dramatically boost the performance of the existing Molonglo Observatory Synthesis Telescope (MOST) as part of its transformation to the Square Kilometre Array Molonglo Prototype (SKAMP). The heart of the new system is based on programmable logic chip technology which has taken SKAMP to an international level of functionality by making the telescope more flexible, three times more sensitive, with ten times more bandwidth, and able to make better-quality images of the sky. Breakthrough technology for speed and efficiency of teraflop computational loads is an important part of the design of the Square Kilometre Array (SKA), an international project to build a radio telescope, which will be 100 times more sensitive than any existing radio telescope with one million square metres of collecting area.

SKAMP is part of the University and CSIRO program to develop and test new technology leading to the SKA. "This project has given our telescope a whole new capability," said SKAMP project leader, Professor Anne Green. "It looks the same, but under the bonnet it's been born again." Duncan Campbell-Wilson, Molonglo Observatory's Site Manager, agrees, "It's been an interesting 50-year evolution here at Molonglo - from 1960 when the Mills Cross led the way in pioneering radio telescopes to its rebirth as MOST and now to SKAMP." Mr Campbell-Wilson says that the observations with SKAMP are built on the back of innovative electronic engineering, which will allow us to look deeper into the Universe and provide spectral line capability for the first time on this telescope. This very large University-operated radio telescope will look to the distant Universe to study evolving galaxies and will search for transient and variable radio sources, a research window wide open for new discoveries.

MOST has only 3MHz of bandwidth, centred on 843MHz. The new digital correlator and filterbank system has increased the bandwidth to 30MHz (around the same central frequency). As a result, the telescope's sensitivity has improved by a factor of three, producing deeper images with spectral information, which is something new for this telescope. The data-flow rate has increased by an astonishing factor of 10,000. To transform MOST into SKAMP, the University has also upgraded the telescope's mechanical drive, changed the signal receivers, and replaced copper cables with fibre optics. The University plans to further enhance the telescope with a new dual polarization feed system, which will boost the bandwidth by another factor of three, up to 100 MHz, and allow measurements of cosmic magnetic fields. The frequency range has been broadened to cover from 650 MHz to 1200 MHz. The formal handover of the complex digital system recently took place at the University of Sydney between CSIRO SKA Director, Professor Brian Boyle, SKAMP Project Leader, Professor Anne Green, pictured above left, and Mr Wayne Arcus of the Murchison Widefield Array (MWA) project.

Significant funding for the SKAMP project was provided by the Commonwealth Government, under the second round of the Major National Research Facilities program with additional substantial support from the Australian Research Council.

# ISS2011 LIGHT & MATTER

As many of you will know the Professor Harry Messel International Science School (ISS) is a free, biennial science educational program that honours excellence in outstanding Year 11 and 12 students and encourages them to pursue careers in science. Around 145 ISS scholars attend from over all Australia, China, Japan, India, Malaysia, New Zealand, Singapore, Thailand, UK and the USA. Since 2005 five Indigenous Science Scholar places are awarded as part of each ISS to encourage indigenous Australian students' interest in science.

In 2011 the ISS theme is *Light & Matter*. This theme brings together work being carried out in physics, chemistry, biology and engineering. Sir John Pendry, the invisibility and cloaking pioneering scientist will be a keynote lecturer with Dr Karl Kruszelnicki AM, our Julius Sumner Miller Fellow and media personality also an ISS guest speaker. (As a veteran of the ISS and renowned science communicator, Dr Karl is also one of the most popular!)



All ISS scholars are chosen on their academic ability and, depending on their country, must compete for an ISS scholarship through either essay writing, an interview or sitting an exam. In the USA the ISS is awarded as a prize in the National Science Bowl run by the US Department of Energy. ISS scholars live on campus for their two-week stay and for many it is an opportunity to visit Sydney for the first time, as well as to meet like-minded peers from different countries and cultures. The ISS program reflects the different themes of each ISS and comprises lectures, hands on experiments and challenges as well as social activities.

Over the past 40 years the ISS has secured its place internationally as an outstanding program and now has over 4,000 ISS alumni, many of who have gone onto great achievements in science and related areas. The ISS is held primarily within the School of Physics and is funded by the Science Foundation for Physics.

*The ISS2011 will run from 3-16 July 2011. ISS Applications will be available from the Science Foundation for Physics website from January 2011 (please note the Foundation does not select the ISS Scholars). Visit: [sydney.edu.au/science/physics/foundation/](http://sydney.edu.au/science/physics/foundation/)*

# HONG KONG ALUMNI

Alumni of the University of Sydney are cordially invited to the 2010 Hong Kong Alumni Reception, which will take place on Monday 25 October from 7pm to 9pm at the World Trade Centre Causeway Bay, Hong Kong. The reception will be hosted by Vice Chancellor, Dr Michael Spence. For more information or to RSVP please email Eve Simon - [alumni.rsvp@sydney.edu.au](mailto:alumni.rsvp@sydney.edu.au)

