



## PHYSICS

### Life, The Universe, Everything

Few disciplines can pull off carrying such an all-encompassing motto, but that is the spirit that has seen the School of Physics at UWA grow from strength to strength in many areas including teaching, research and postgraduate supervision. Boasting 12 strong research groups across nine research areas, teaching in the School is well supported and informed by research. This has led to close relationships being forged between students and research staff, with opportunities being provided to students completing undergraduate studies to progress

into postgraduate study and a research career.

The past two years have been keyed by incredible development across the board and the winning of numerous local, national and international awards by staff and students alike.

This annual Physics Alumni Newsletter seeks to display the many personalities that make the School of Physics what it is, to create a conduit between the present, the past and the future and, to highlight the numerous achievements of the staff and students of the School.



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THE UNIVERSITY OF  
WESTERN AUSTRALIA

*Achieving International Excellence*

EDITORIAL

## The Goethe Principle

'Whatever you can do or dream you can, begin it. Boldness has genius, power and magic in it. Begin it now', is how Johann Wolfgang Von Goethe put it. This was the guiding principle for Dr Chris Thorne & I in setting up the UWA Virtual Universe project. I am sure that this is also the principle that underlies the many achieve-

ments of staff and students in the School of Physics. This is also evident in how work experience students, Holly & Ethan Triplett, Year 10 students from Thornlie Christian College and Li Pung of Methodist Ladies College, have over a matter of weeks put together the foundations for the renaissance of the Phys-

ics Alumni newsletter, and its rechristening as **WAVES**. The waves of the ocean lap across distant shores, and Physics has that same unique quality, cutting across all industries, all races, all ages, all countries and all boundaries ... even space ... and time.

WORD FROM THE TOP

## Heads Up

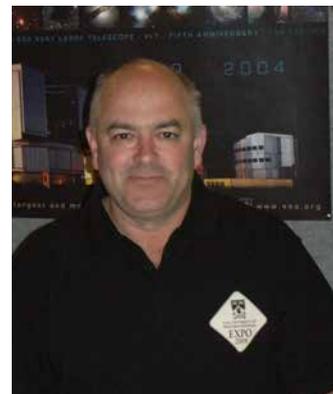
It has been some time since our last alumni newsletter as we have been relying on the Faculty newsletter, *Science Matters*, for communication of news about developments in the School to alumni. However, under the editorship of our new School Manager, Jay Jay, we are reinstating our own yearly (more often if we're able) newsletter for direct communication with Physics alumni.

The last few years have been very exciting ones in which the School of Physics has continued to consolidate its strategic objective to be one of the most research-intensive schools

in the University, whilst maintaining a high-quality core of undergraduate teaching. The School underwent an external review of its activities and vision in May as part of the University's regular cycle of review, and whilst the final report is yet to be received, informal feedback from the review committee was extremely positive.

It is worthwhile considering just what we mean when we talk of 'the School of Physics.' Whilst the School has a physical presence in the form of the Physics Building with its not insignificant research and teaching infra-

structure, it is in the staff and students, both past and present, that the spirit of the School of Physics resides. I hope that interest and involvement of alumni will continue to be a strong part of that spirit. To this end, we are planning to host an alumni function in the not too distant future - so keep your ear to the ground!



**A/Prof Ian McArthur**  
**Head of School**

## Head-On Collision

Watch this space. In years to come, Stuart Napier, a finishing PhD student at the School of Physics, UWA, could be in line for even higher honours! No, he did not win the Nobel Prize for Physics, but he was the only West Australian student to be sent by the Australian Academy of Science to the 2008 Meeting of Nobel Laureates in Physics at the picturesque German island town of Lindau in July. About twenty Nobel Laureates gather in Lindau every year to deliver lectures to, interact with and inspire young scientific researchers from around the world. The meeting provides a unique opportunity for young scientists to talk face-to-face with some of the world's great minds.

The Meeting of Nobel Laureates has taken place annually since 1951. The featured discipline rotates yearly, and in 2008 it was Physics' turn. Stuart was among the 600 or so participants from over 50 countries, and was hosted by Countess Sonja, of the illustrious House of Bernadotte (Royal House of the Kingdom of Sweden). Also present were the German Federal Minister for Education, a member of the Thai royal family and high-level representations from Audi & Mars Corporation.

His supervisor, Professor Jim Williams said, "Attendance at a meeting of Nobel Laureates in

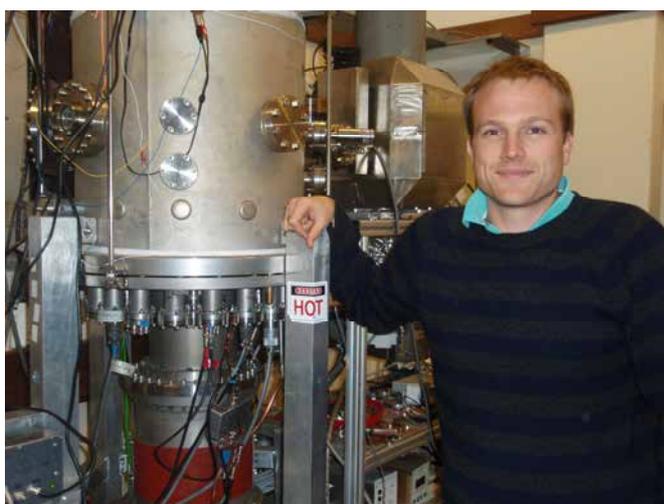
Physics is usually a once-in-a-lifetime opportunity. Stuart gained his place amongst other postgraduate students after applying outstanding experimental skills in atomic physics. After excellent undergraduate studies he joined the atomic physics team of the ARC Centre of Excellence for Antimatter and Matter studies which has developed internationally leading experimental facilities for such studies. Stuart's contributions readily reflect the attainment of international excellence and his colleagues are waiting with great interest to read his PhD thesis and to see where his achievements and opportunities will lead."

Stuart conducts experiments investigating collisions between atoms and electrons, and observes the effects of processes that take only a few femtoseconds (a millionth of a nanosecond) to occur. After colliding, atoms emit light and one of the spinoffs of the work is that it may

contribute towards finding new, more efficient and environmentally-friendly light sources.

Stuart explained, "For me the highlight was being able to listen to and converse with Nobel Laureates. This kind of exposure to scientists of their calibre, in particular hearing them describe the processes by which their achievements were reached, is of invaluable benefit."

Given the high-profile environmental issues are attracting at the moment, fundamental research with potential to contribute to more efficient use of energy will become more important in years to come. Perhaps some day all of Perth will be lit using techniques developed by Stuart, and the world will see a new 'Wizard of Menlo Park'.



**Stuart Napier with a high resolution spin-polarised electron impact spectrometer**

## Dance Across the Rio Grande

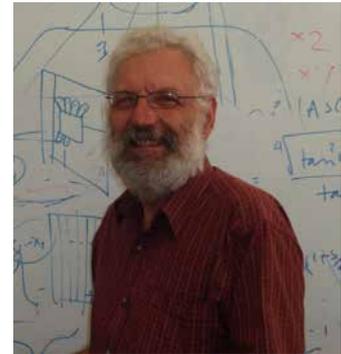
A Eureka moment is years in the making. That moment came in 2005 when Dr Frank van Kann and mining giant Rio Tinto joined forces in research to forge a new and innovative method for mineral exploration, the *cryogenic gravity gradiometer*.

This commercial research project is now one of the jewels in the Physics research crown, especially given the growth and expansion of the mining industry in Western Australia over the past few years.

The potential of the gravity gradiometer that Frank is working on has seen the growth of his research from a one-man enterprise in 2004, to a thriving industry-based research group of more than ten in the span of a mere four years.

Life's journeys are always fascinating. Since an early age, Frank had an interest in Physics, and things have come full circle as they always seem to do. Frank was an eager undergraduate student at the School of Physics here at UWA. He then moved to Stanford Uni-

versity in the United States to further his career, but the pull of UWA was too strong and, lucky for us, he's back where he belongs!



**Dr Frank van Kann**

## She's All Locked Up

On the 23rd of July 2008, after years and years of diligence and effort, the Australian International Gravitational Research Centre (AIGRC), led by Professor David Blair in its mission to detect gravitational waves, came closer to its goal when they celebrated the successful locking of the suspended mirror cavity using UWA's Advanced Vibration Isolation and Suspension System on the east arm of their High Optical Power Research Facility in Gingin.

The ability to lock the laser frequency to an 80-meter optical cavity with suspended mirrors in vacuum requires the elimination of seismic vibrations.

Instrumental in this triumph were the efforts of the group's PhD students, Jean Charles Dumas, Pablo Barriga-Campino, and technicians Andrew Woolley, Steve Pople and Peter Wilkinson under the tutelage of Research Director, Dr Chunnong Zhao.

As David put it, "Imagine going into a forest and not hearing the wind in the trees, the birds

chirping or water rushing through a nearby brook. Gravity waves are the sounds of the universe."

The world waits in anticipation to listen to your song.



**Remote cameras capturing the historic moment. The illuminated spots are laser beams locked to any residual motion of the mirrors**

## Astro Boy!

The expansion of research in the field of Astronomy & Astrophysics in the School of Physics since Premier's Fellows Professor Peter Quinn and Professor Lister Staveley-Smith arrived at UWA in 2006 has been nothing short of breathtaking.

One facet of the expansion has been the arrival of PhD student, Toby Potter, who has a penchant for peering into the universe.

In 1987, light from a titanic stellar explosion reached earth. Two astronomers, Ian Shelton and Albert Jones, were credited with the discovery and soon telescopes all over the planet were trained on a little patch of sky in the Large Magellanic Cloud that contained the Type II supernova SNI1987A.

In the months following the discovery, a bright UV flash from the explosion illuminated the stellar region surrounding the progenitor, revealing a beautiful three-ring structure thrown off by the star in earlier phases of its evolution.

Below is a recent Hubble photograph of the three rings. The beaded effect in the central ring is indicative of a shockwave colliding with it and exploiting weaknesses within its structure.

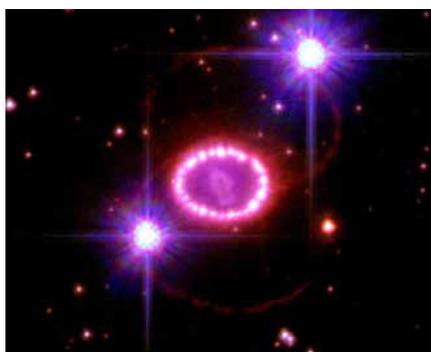
Toby uses the iVEC supercomputer *Marron* to simulate the supernova explosion and subsequent interaction with the ring. A by-product of the shock interaction is synchrotron emission, a highly non-linear effect produced when charged particles are accelerated to extremely high energies and spiral around magnetic fields left over from the progenitor emission, hopefully furthering understanding of possibly one of the most important sources of cosmic rays.

Supernovae are believed to be the primary source of cosmic rays, which slam into our atmosphere and can possibly trigger lightning strikes. One aspect of Toby's

work will be to use these simulations to write algorithms that model this particle acceleration and subsequent radio emission.

"After completing my BSc (Hons) in physics and astrophysics at the Australian National University, I came over here to do a short term research project with Lister. After a few months it became clear that Western Australia is quickly going to become a major centre for astronomy and astrophysics, so I decided that this is where I want to be."

"His work is fascinating, but just as significant is his ability to communicate the importance of astronomy and astrophysics research to the younger generation. Both Toby and Jacinta (see page 6) have been huge assets to the outreach repertoire of the School," said School Manager, Jay Jay Jegathesan.



**Supernova 1987A (December 2006)**  
NASA, ESA, P.Challis, and R. Kirshner  
(Harvard-Smithsonian Center for Astrophysics)



**"Both Toby & Jacinta have been huge assets to the outreach repertoire of the School"**

## RESEARCH SHORTS

## Synchronicity



Dr Peter Hammond leads the Experimental Quantum Dynamics Research Group. One of the main projects he is currently engaged in involves inventing and perfecting a new method for recording how long it takes charged particles to cover short distances.

His research group invented a new method a few years back to measure time differences as small as a millionth of a millionth of a second. The process involved was invented in 1998 by him and has taken 10 years to take its current shape.

Another major project involves the Synchrotron, where electrons are injected into a small electrostatic ring. It is a collaborative international project with partners in Canada and Italy, among others. One of his recent highlights was the signing of an agreement with Sincrotrone Trieste, Italy.

Peter has also recently led the development of Outreach modules for secondary school students.

## Astro Girl!



Jacinta Delhaize is an Honours Student supervised by Professor Lister Staveley-Smith, undertaking a project in Radio Astronomy.

Jacinta examines the interaction between the Milky Way and its neighbouring galaxies: the Large and Small Magellanic Clouds (irregular galaxies). It seems that every now and then a clump of our galaxy is ripped off by the two of them. Jacinta also analyses the gas

and dust content of the clump that was ripped off. Winner of the Australian Gemini Undergraduate Summer Studentship to Chile in 2007, she is actively involved in Outreach, having given numerous talks on the Square Kilometer Array during school incursions to UWA and also at excursions to schools such as Christ Church Grammar in Claremont and John Septimus Roe Anglican Community School in Mirrabooka.

## Quantum Balance



While heading the Quantum Dynamics and Computational Research Group alongside Dr Paul Abbot, Associate Professor Jingbo Wang has learned to perfect the balance between teaching and research.

Jingbo teaches into the 1st, 2nd and 3rd year programmes while at the same time delving into research on manipulative quantum systems to process information in a more efficient way. Her work on quantum computing aims to allow us to

solve problems within hours that would take millions of years using current computers. Her research spans atomic and molecular physics, computational physics, nanostructured electronic devices and quantum information and computation.

Appointed as the School Seminar Coordinator in 2008, her drive and enthusiasm has seen packed seminars with a significant increase in the number and quality of talks delivered at the School.

# Controlling the Quantum World

## The Science of Atoms, Molecules and Photons

The ARC Centre of Excellence for Antimatter and Matter Studies [CAMS] exploring positron and electron physics at UWA comprises a formidable team. Led by Professor Jim Williams, the team includes Dr Sergey Samarin, Dr Danica Cvejanovic, Dr Luka Pravica, Dr Tony Sergeant, Stuart Napier, Paul Guagliardo and Peter Wilkie. Their achievements continue to attract international attention and funding.

Stuart Napier, while writing his PhD thesis, was selected by the Australian Academy of Science to attend the 2008 Meeting of Nobel Laureates in Physics (see page 3 for full details). In July and August 2008 Dr Sergey Samarin visited St Petersburg Technical University to assist with the development of a new detector of the spin of slow electrons similar to that installed at UWA. He also visited the Max Planck Institute for Microstructure in Halle, Germany to observe advances with controlled positron beam studies. The knowledge is expected to lead to major advances in the UWA experiments observing how and why positrons can bounce from surfaces. Peter Wilkie has just submitted his MSc thesis based on how to observe slow positrons and how to make them travel more slowly. Other members of the positron group, Dr Tony Sergeant and Paul Guagliardo, are spending some months in the Materials Engineering Division at ANSTO collaborating with Dr Suzanne Smith (ANSTO) and Prof Akira Uedono (Institute of Applied Physics, University of Tsukuba, Japan), a leading international expert with measurements of

Positron Annihilation Lifetime Spectroscopy (PALS). The work is observing how picoseconds positron lifetime can reveal the porosity and defects in surfaces which, of course, depends on how the positrons can bounce around in tiny 'wormholes' of nanometer dimensions before they find an electron to annihilate. Such studies of quantum motion provide the basis for a study of polymers which may be insulators, semiconductors or conductors and give rise to the fascinating world of 'plastic electronics'.

Jim and Danica attended the International conference on Many Particle Spectroscopy of Molecules, Clusters and Surfaces in Paris in July 2008 where the discoveries by Luka, Stuart and Danica attracted much attention. Their experimen-

tal work shed new light on how the correlated motion of electrons from the inner 3d and outer 4s shells of zinc atoms can resonate outside the ionization boundaries of an atom. This study of quantized motion is based on angular momentum transfer. Underpinning much of this experimental work are the achievements of Steve Key and colleagues in the Physics Workshop.

The culmination of much recent research will be highlighted in two international meetings at UWA. From 19 - 21 November 2008, the ARC CAMS group will hold an International Workshop on positron and electron quantum phenomena and from 24 - 28 November, Jim and his group are the local organisers of the 8<sup>th</sup> Asian International Symposium on Atomic and Molecular Physics (AISAMP) which is held in Australia for the first time.



## The Icemen Cometh!

The recent showing by SBS of 'The Race for Absolute Zero', of the battles between James Dewar, Heike Kammerlingh Onnes & Lev Davidovich Landau to approach *absolute zero*, the holy grail of cryogenic research, has sparked significant interest in liquid nitrogen and liquid helium among the many work experience and Outreach students who spend time with staff of the School of Physics (and also among the general public). Lance Maschmedt and Joe Coletti are the Dewars and Landaus of UWA insofar as Outreach is concerned. When asked what he thought was the single most fascinating thing for school kids during Outreach presentations, 'liquid nitrogen', was the instantaneous response from Lance.

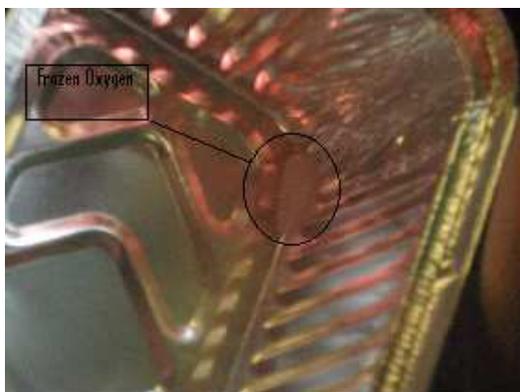
Everyone loves liquid nitrogen ( $\text{LN}_2$ ) and Lance and Joe are past masters at displaying its properties in full glory. They have also trained up many undergrad and postgrad students in the art of Outreach with  $\text{LN}_2$ .

This brings us to the gatekeeper of all things frozen in the Physics workshop, Dave McPhee. A lot of research at cryogenic levels at the School would not be possible were it not for Dave's tireless efforts in the Schools' liquid helium plant. He's been known to let his hair down as well and mix it with the best of the Outreach demonstrators, as displayed by his treatment of the apple in the photos below.

Two Nobel prizes have been won between  $-268^\circ\text{C}$  and  $-273^\circ\text{C}$ , and if you're looking for Lance, Joe or Dave, that's where you're likely to find them!

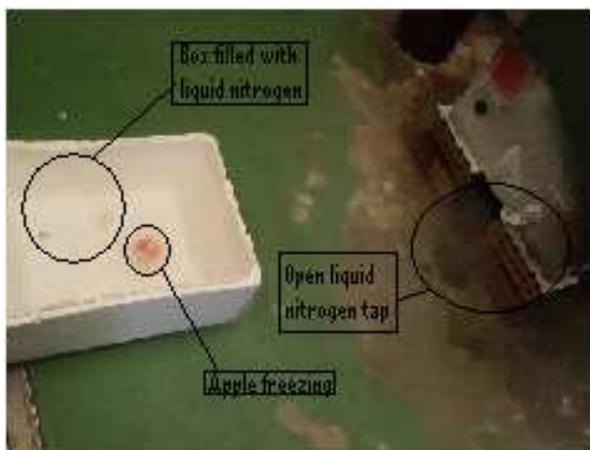


**Joe Coletti**



**Frozen oxygen**

**The liquid nitrogen in the tubes is so cold that the oxygen around it freezes**



**An apple being frozen in liquid nitrogen by Physics workshop technician, Dave McPhee**



**Bits of the smashed frozen apple**

# A Day With Andre

as told by Work Experience Student, Ethan Triplett



A/Prof Andre Luiten

In August I had the opportunity to spend a day with Andre in his lab. Andre does research in Frequency Standards and Metrology. Andre's lab was awesome.

When I arrived he handed me plans and instructions to see if I could build a circuit board, an assignment he had set for his students. As I love electronics and circuitry I couldn't wait to get started, so I immediately began to build a working electrical circuit with

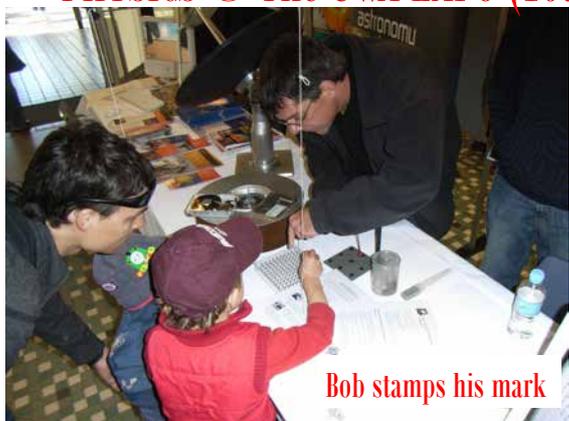
flashing lights and switches. I had to solder all the wires and switches together and connect a 9V battery and then place this in a hard plastic casing. Success! My project worked, first time.

Before coming to the School of Physics I was very focussed on studying Mechatronics, but now after experiencing so many interesting and fun things I really want to study at the School of Physics. I had no idea of

the incredible fun research that is conducted here and I cannot wait to come again.

*Editors Note: We soon hope to have a whole horde of potential converts running through Andre's lab!*

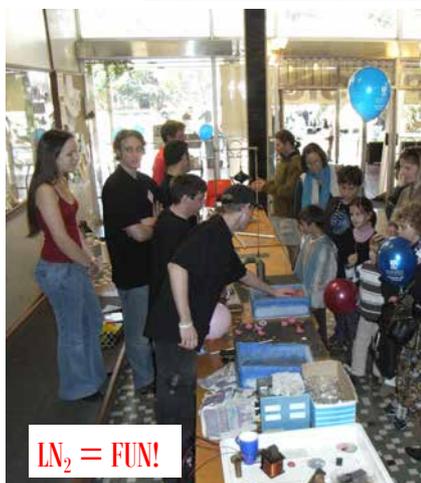
## PHYSICS @ The UWA EXPO (10th Aug 08) - A Pictorial Review



Bob stamps his mark



Everybody say jump!



LN<sub>2</sub> = FUN!



This is how you boogie



Ruby & Amanda make all kids smile

## Flowers of the Sun

'A man of many talents' is a mild way to describe School of Physics Honorary Research Associate, Dr Chris Thorne, whose artwork *Rainbow in a Storm* was one of the pieces on display at the Art Gallery of Western Australia, for the Art in Bloom Exhibition from 22 – 24 August 2008. This artwork, a collaborative piece with acclaimed WA artist, Stormie Mills, was unique in that it was the first-ever digital interactive artwork displayed at the Art Gallery of Western Australia.

The past year has been a whirlwind of activity for Dr Thorne, as within the past 12 months he has completed his PhD, become a Research Associate with the School of Physics, created a 3D interactive virtual world called 'The UWA Virtual Universe Project', won an international Google Earth prize for 3D modelling, created VR Shed Pty Ltd, a start-up company creating 3D models and operating in 3D digital interactive social spaces and now, thanks to 'Art In Bloom', he has become a Virtual Artist!

"I was really surprised how people

were willing to interact with the piece and how many understood the message of the piece – which is how people tend to get into a mental rut and not make an effort to get out of it," said Chris.

'Art in Bloom' is an exhibition of floral-based responses to artworks already installed in the gallery. The response installations are placed in proximity to the art pieces they respond to. In Chris' piece, one sees a man contemplating the sea, feeling a bit down. Stormy clouds reflected in the murky sea, match his mood. He does not notice the rainbow nor see the rays of warm sunlight (represented by sunflowers) piercing the clouds. Two catfish are nearby, one of whose viewpoint the participant takes in the installation. An interactive bar has been created that allows the 'beholder' to move the position of the man and the fish.

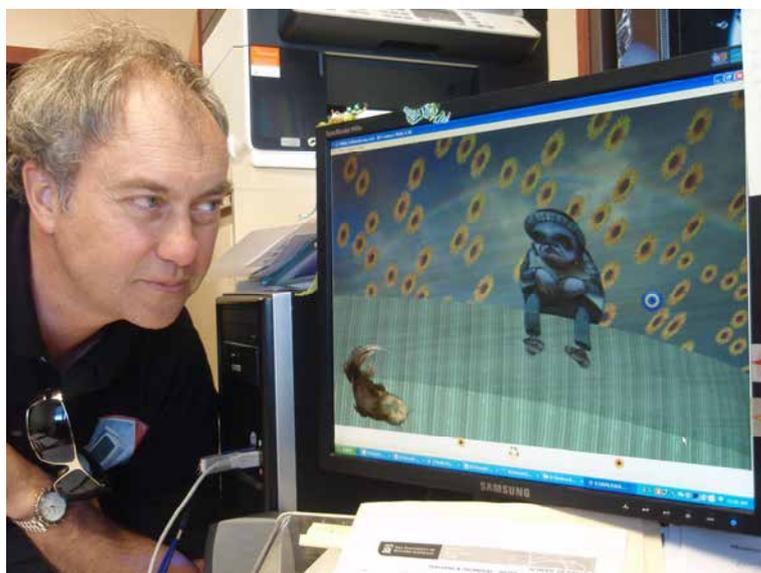
"Being a digital interactive artwork in a major art gallery, it

breaks new ground so hopefully this creates more interest in digital interactive works and 3D modelling, a field I am working in now."

### Virtual Universe Project

Chris, along with Jay Jay Jegathesan, are co-founders of the UWA Virtual Universe Project, led jointly by the School of Physics and the School of Computer Science and Software Engineering. Anyone from around the world can log-in, select an avatar and roam around a 3D virtual representation of the grounds of UWA and also the projected site of the Square Kilometer Array. The text for the site was written by Physics Senior Honorary Research Fellow, Dr John Robins and Ms Louisa Chawhan of UWA's Centre for English Language Teaching. This is an international effort with collaborators from Perth, Queensland, New South Wales, Canada, Mexico, Brazil and the USA.

<http://www.csse.uwa.edu.au/virtual>



**"Being a digital interactive artwork in a major art gallery, it breaks new ground"**

# Physics Honour Roll 2007-2008

Date	Name	Current Status	Award
Aug 08	Adj A/Prof Martin Ebert	Staff	Roberts Prize, best paper published in 2007
July 08	Edd Stockdale	Student (PhD)	The Daniel Jouvance Prize
June 08	Dr Jean-Michel Le Floch	Staff	URSI (International Council of Science) Young Scientist of the Year Award
June 08	Stuart Napier	Student (PhD)	Australian Academy of Science PhD delegate to the 2008 Meeting of Nobel Laureates, Lindau
May 08	Prof Mike Tobar	Staff	Excellence Award - Postgraduate Research Supervision
May 08	A/Prof Ian McArthur	Staff	Commendation - Coursework Teaching
May 08	Karen Livesey	Student (PhD)	IEEE Magnetics Society Winner: Student Travel Grant Finalist: Best Student Paper Award
May 08	Paul Stanwix	Student (PhD)	NMI Australia Prize
May 08	Alexandra Howie	Student (UG)	Selected for AINSE Winter School
May 08	Marc White	Student (Hons)	Tesla Prize and Medal in Experimental Physics
May 08	Jenni Gorham	Student (Hons)	Physics (Level 3) Prize
May 08	Keal Byrne	Student (Hons)	Physics Achievement (Level 3) Prize
May 08	Stephen Parker	Student (PhD)	Muriel & Colin Ramm Medal in Experimental Physics
May 08	Jack Moore	Student (UG)	Digby Fitzhardinge Memorial Prize
May 08	Christopher Mofflin	Student (UG)	Lady James Prize
May 08	Zoe Budrikis	Student (PhD)	Maslen Physics Prize
Apr 08	Prof Peter Quinn	Staff	Thompson HiCi Author
Mar 08	Prof Bob Stamps	Staff	Promotion to Professor
Mar 08	Jesse Searls	Grad & Industry Partner	2008 Sawyer Award
Feb 08	Annette Tyler & Becky Fuller	Students (PhD)	Best Poster - International Conference on Nanoscience and Nanotechnology, Melbourne
Feb 08	Jay Jay Jegathesan & Dr Chris Thorne	Staff	1 <sup>st</sup> Place Winner - Google Earth "Build Your Campus in 3D" – Australasian Award

# Physics Honour Roll 2007-2008

~ Continued ~

Oct 07	Prof Bob Stamps	Staff	IEEE Magnetics Society Distinguished Lecturer for 2008
Oct 07	Prof David Blair	Staff	Western Australian Scientist of the Year
Sept 07	Jacinta Delhaize	Student (Hons)	Australian Gemini Undergraduate Summer Studentship, Chile
July 07	Lance Maschmedt	Staff	Carrick Institute Citation for Outstanding Contributions to Student Learning
May 07	Jenni Gorham	Student (Hons)	Digby-Fitzhardinge Prize & UWA Graduates Association Prize in Mathematics and Computer Science (Level 2)
May 07	Gar-Wing Truong	Student (Hons)	Digby-Fitzhardinge Prize & UWA Graduates Association Prize in Physics, Geology and Chemistry (Level 2)
May 07	Dustin Stuart	Student (UG)	Lady James Prize in Physics & UWA Graduates Association Prize in Physics, Geology and Chemistry (Level 1)
May 07	Zoe Budrikis	Student (PhD)	Lady James Prize in Physics Science & Physics (Level 3) Prize
May 07	Brendan Douglas	Student (Hons)	Maslen Physics Prize & Faculty of Life & Physical Sciences Medal & J.A. Wood Memorial Prize for most outstanding honours graduand in the Sciences
May 07	Anthony Milton	Student (UG)	Physics Achievement (Level 3) Prize
May 07	Paul Guagliardo	Student (PhD)	Muriel & Colin Ramm Medal in Experimental Physics
May 07	Owen Heatherington	Student (UG)	Tesla Prize and Medal in Experimental Physics

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