SCHOOL OF PHYSICS REACHING PHYSICS ALUMNI

From the Head of School

WELCOME TO THE third Alumni Newsletter from the School of Physics. It has been very pleasing to receive positive feedback about the Newsletter. ***I invite Alumni to consider contributing to the Newsletter to share stories of success.***

As mentioned in first Newsletter, we will take the opportunity to feature a research group in each issue. The centre of this issue is devoted to the ***Gravity Waves Research Group***.

The School has seen a few changes this year. The ***School website*** ***(***http://physics.uwa.edu.au***)*** has recently been totally revamped. The new site is more user friendly and includes a lot of pictures of activities in the School. Our thanks go to Peter Kapitola, who undertook most of the work during a vacation scholarship under the supervision of Dr Paul Abbott. We would appreciate any feedback or suggestions you may have. ***The School organises a series of seminars presented by School staff, visitors and guests. The announcements for these seminars are available on the School website and I would like to invite Alumni to attend and, if they wish, contribute to these seminars.***

Nearly all of you will remember "Budgie." ***John Budge*** (pictured below, left) retired in April due to family reasons after almost 50 years of continuous service to the School in a technical capacity. He commenced duties as an apprentice instrument maker in the Department of Physics in 1947, the first apprentice taken on by the University. Over the years, Budgie has made an incalculable contribution to the research efforts of the School through his ingenious approaches to the design and building of precision scientific equipment. This is evidenced by the fact that he holds a number of patents for his innovations. ***John was awarded Chancellor's medal for his many years service to the University.*** We will also miss Budgie's good sense of humour, his joy for life, and his deep concern for the welfare of all those around him, particularly students**.**

Congratulations to Associate Professor Bob Stamps from the Nanomagnetics and Spin Dynamics Group in the School. Bob has been chosen as the ***EP Wohlfarth Memorial Lecturer*** for 2004. The Wohlfarth Lecture is an annual event which is held during the international Condensed Matter and Materials Physics conference. Wohlfarth lecturers are selected for the achievement of prominence in the field at a relatively young age. Bob has also been invited to spend time as a 'Guest Professor' at University of Paris VII in 2005.

The Tesla Forum has made a generous offer to donate a prize in Physics, the "Tesla Medal". The Tesla Forum promotes recognition of the contribution to 20th century technology which resulted from the pioneering work of Nikola Tesla in experimental physics. The year 2006 will mark the 150th anniversary of his birth. He held 700 electrical patents and was responsible for 1500 inventions. The School has recommended that the Tesla Medal be awarded to the best student in the experimental physics in third year of a major in Physics. We are very grateful to the Tesla Forum for the opportunity to celebrate excellence in our students in the name of Nikola Tesla.

In 2005, UWA will introduce a new degree in ***Nanotechnology.*** The School is pleased to be participating in this multidisciplinary programme together with Chemistry, Electrical and Electronic Engineering, Materials Engineering and some of the Biological Sciences. Students will have the option to specialize on one of four streams (Physics, Chemistry, Engineering Science or Biology) whilst also attaining competence in the other three. The degree is attracting a lot of interest from students, and has served to strengthen links between the disciplines participating in its delivery.

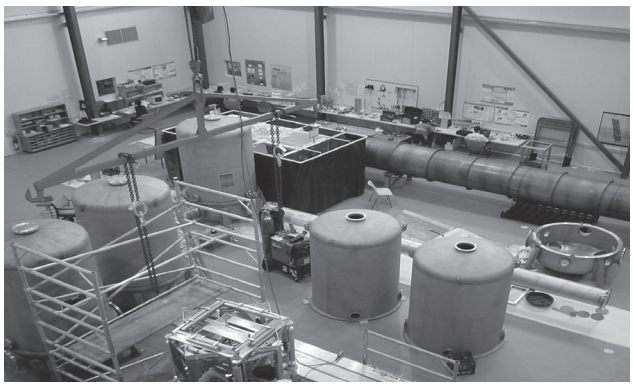
We are very fortunate to be able to welcome ***Dr Danica Cvejanovic*** (pictured left) from Manchester, who has joined Atomic, Surface and Molecular Physics research group. Dr Cvejanovic has a PhD from University of Belgrade and she is internationally renowned in the field of electron impact ionization.

Ian McArthur

GRAVITY AT GINGIN

For 20 years through the 80's and 90's the then Department of Physics developed and operated a resonant mass gravity wave antenna, dubbed Niobe. ***This detector consisted of the world's largest piece of niobium cooled to cryogenic temperatures. The detector achieved several records, and operated almost continuously from 1993 to 1997 and again in 2001.*** With 4 other detectors it set new limits on the strength of gravity wave signals, but despite a few false alarms, no signals appeared. This was not really a surprise: it merely told us that nature was not so kind as to provide us with an unexpected number of black holes in our galaxy. What we did discover was how to make some beautiful new devices…especially sapphire oscillators and vibration isolators.

In the 1990's we made the strategic decision to embark on the laser interferometer technique of gravity wave detection. This technology also needed our vibration isolation techniques but otherwise was very different. It needed a large isolated facility to house a long baseline interferometer.



Inside AIGO

Over the past 4 years an isolated piece of pristine bush land about one hour's drive from Perth, between Yanchep and Gingin, has been developed into a unique science centre. It was first conceived as an ideal site for ***AIGO, the Australian International Gravitational Observatory.*** Since then it has developed into a centre that not only supports gravitational wave research, but also a public education centre called the ***Gravity Discovery Centre***. AIGO has been developed under the auspices of the ***Australian Consortium for Gravitational Astronomy*** (ACIGA), which combines UWA, ANU, the University of Adelaide, Monash, ECU and the CSIRO Centre for Precision Optics. The GDC has been developed by the community based Gravity Discovery Centre Foundation, with most funds coming from industry and business donors. All told almost 100 individuals have brought special expertise to create a most exciting science centre. The centre is designed to promote physics and also to show that science is part of a much bigger whole which encompasses the environment, the universe, art and science.

The Gravity Discovery Centre's Southern Cross Cosmos Centre which includes the 25 inch Brodie Hall Telescope

The concept for the entire Gingin Gravity Discovery Centre emerged when the WA ex-deputy premier Hendy Cowan suggested to his staff that there had to be more benefit to WA than just a mob of boffins beavering away in the bush! ***The dream of the physicists was to create the southern hemisphere gravity wave detector that was needed to turn the world array of detectors into a true omni-directional gravitational wave telescope.*** But the demand was that we also contribute to school education and provide a facility that would contribute to WA and to the Gingin region in a much broader way. Recently in one week nearly 500 school students visited the centre taking education modules from magnetism to waves, nasty creepy crawlies to solar astronomy. *You can read more about the GDC in the enclosed flier.*

GRAVITY WAVE DETECTORS WORLDWIDE

The quest to detect gravity waves has been gradually hotting up for the last 30 years. ***What began as one-man research by an eccentric physicist, the late Joseph Weber, has grown into a field that commands funding on the billion dollar scale and which at last looks certain of detecting gravity waves in the foreseeable future***. Indeed, the planned space based detector LISA which will be a 5 million km laser interferometer has its sensitivity limited by gravity wave noise….the confused clutter of signals from the prolific sources in the 100 microhertz band. The present terrestrial detectors which are being tuned up (LIGO in the USA, VIRGO and GEO in Europe) will not be so lucky. At their present sensitivity they only have a small chance of detecting *known* signals. However when *advanced techniques* are applied to them, giving them a 10-fold improvement in sensitivity, they will detect prolific known sources…somewhere between one per hour and one per day. Hundreds of physicists around the world are working towards this exciting goal. AIGO at Gingin, and the Australian Consortium which runs it, is currently working to develop some of the key aspects of this technology.

THE GINGIN HIGH OPTICAL POWER PROJECT

The first goal of AIGO is to develop techniques to allow laser power of the order of 1MW to be utilised in sensitive interferometers. This power is to be built up by resonance

from an injected power of ~100W. The need for power arises because sensitivity is set directly by photon statistics. More photons translate into better statistics and less noise. But to work at such high power levels introduces a whole new suite of problems, not the least being the hazard of such intense radiation. (We use infrared lasers at 1micron wavelength). The first technical problem is thermal lensing….optical distortions like mirages which arise because of the heating of lenses by absorbed laser light. The second problem is radiation pressure. At 1MW the radiation force acting on the mirrors is a few millinewtons. But the force acts only over the nanometer width of the optical resonance. This translates into a spring which is comparable to a trampoline spring! The optical spring effects can cause optical cavities to become wildly unstable. Our goal is first to create the optical springs and then to learn how to control them. In May the first optical experiments began at Gingin.

The high power experiments are being done in a close collaboration with the US LIGO project. Dr Bram Slagmolen is the project scientist, and most members of the group are spending substantial time on site helping in various ways. Recently Dr Mark Barton, a LIGO scientist from Caltech spent two months working at Gingin helping to get the experiments going. Most of the equipment is now completed.

GINGIN SUPPORT EXPERIMENTS

Many experiments are underway to support the Gingin developments. At UWA a complete vibration isolator has been developed and a big team is working on testing and controlling the system. The last major hurdle was overcome in May so that now the isolators for the Gingin facility can be completed and installed. ***We believe we have the best isolation system in the world but only the fully operating experiments can verify this.*** Dr Chunnong Zhao and Mr John Jacob and their team have been completing the system and using advanced digital signal processing controllers to enable the extremely complex mechanical systems to be controlled digitally. Another major effort led by Dr Ju Li is in the development of sapphire test masses and their low noise suspension systems. We have developed methods of evaluating the optical properties of the $50,000 sapphire test masses. Close collaboration with the European VIRGO and GEO projects has been very important to this work. Several other PhD experiments allow techniques to be developed in the lab at UWA and then utilised at Gingin.

Other important parts of the project are the analysis of seismic noise, gravitational wave source modeling and data analysis research. This work is led by Dr David Coward and Dr Ron Burman.

AIGO PLANNING MEETING

In April leaders of the major gravity wave projects in the world came to Gingin to meet with ACIGA members to plan the future for AIGO. The 2 day meeting created enormous enthusiasm and a very clear consensus. The first day of the meeting focused on the worldwide array of gravity wave detectors. ***The need for a southern hemisphere detector was emphasised by the international participants, and Gingin was shown to be near the optimum location for this detector.*** The southern hemisphere detector not only increases sensitivity and the number of accessible sources, but it also greatly increases directional resolution of the world wide gravity wave telescope. The recent exciting discovery of a double pulsar was also discussed because the existence of this single system alone greatly increases the certainty of gravity wave detection by advanced gravity wave detectors.

The second day was devoted to gravity wave technology research. This covered a huge range of research, and opened a lot of new collaborative opportunities between all of the participants.

This was the first scientific meeting to take place at the Gravity Discovery Centre. During the meeting a steady stream of visitors arrived to look at the GDC. This vividly demonstrated the public interest in our gravity research. Our overseas colleagues were astonished by the GDC and the exhibits on show***: "Wow! There is nowhere like this anywhere in the world" one physicist was heard to say.***

PRESENT GROUP MEMBERS AT UWA: David Blair, Ju Li, John Jacob, Bram Slagmolen, David Coward, Darren Paget, Leica Kelly, Peter Hay, John Pople, Ken Field, Tim Slade, Vinnie, Eu Jeen Chin, Jean-Charles Dumas, Jerome V Degallaix, Benjamin H Lee, Kah T Lee, Sascha Schediwy, Eric Howell, Xiomei Niu, Pablo Barriga, Michael Feat, Zewu Yan, Hantarto Widjaja, Yi Zhao, Daniel Stone, James Wakeling.

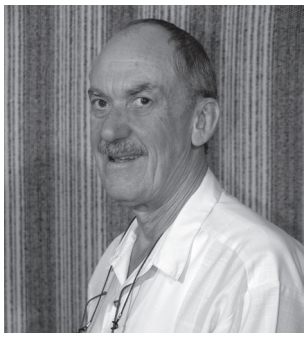
GDC MEMBERS: Chairman John de Laeter, Deputy Chair George Stewart, Treasurer Ron Burman, Education Manager Alan Gent, Astronomy Manager David Nicholson

LEFT: The UWA Gravity Research Group

Highlights of 2004

GETTING CONNECTED TO HIGH SCHOOLS

At a ceremony hosted by Shenton College in March this year, ***the School was presented with a certificate by the Minister for Education and Training, Alan Carpenter, in appreciation for its contributions to the "Learning Links" programme.*** Certificates for outstanding individual efforts were awarded to Mr Lance Maschmedt and to Professor David Blair. The School's involvement is mainly in the provision of "hands on" activities for students illustrating basic physical principles. The "properties of matter at liquid nitrogen temperatures" is a perennial favourite with the participants**.**



Mr Lance Maschmedt (left) and Professor David Blair (right) honoured for their contributions to Learning Links Programme

Once again, Physics did very well in the student ratings for the ***Siemens Science Experience*** for Year 10 students. This event took place in January this year and 195 students participated. The UWA event is the largest one in Australia. In terms of Workshops, the "Physics Circus" of hands-on activities received the highest ranking at UWA from the students. ***This top ranking reflects the enthusiasm and dedication of the demonstrators involved. Associate Professor Tim St Pierre's "Weird and Wonderful Water" was the most highly rated lecture.***

ACHIEVEMENTS OF OUR STUDENTS

Congratulations to our PhD student ***Paul Stanwix***, who has won one of only 12 2004 teaching internships awarded University-wide. Paul will be involved in a variety of teaching activities, as well as participating in a special programme on teaching run by the Centre for Staff Development.

Paul Stanwix enjoying a moment with his son

Congratulations to ***Holly Rose*** and ***Simon Harrison*** on completion of their PhD's.

Congratulations also to ***Ranga Muhandiramge***! Ranga completed joint Mathematics/Physics Honours last year, and is one of the recipients of the ***J. A. Wood Memorial Prizes*** for 2003. There are only two J. A. Wood Memorial Prizes awarded each year by the University for the most outstanding students completing Honours.

VISITORS

Dr Peter Wolf (right) from Bureau International des Poids et Mesures, France is visiting Associate Professor Mike Tobar's Microwave Division of the Frequency Standards and Metrology Group. Dr Wolf not only excels at his research but enjoys surfing as well.

Dr Stefan Katletz from the Johannes Kepler University Linz, Austria, visited Associate Professor Robert Stamps' group under the support of the Austrian Erwin-Schrödinger – Auslandsstipendium. ***Professor David Blaschke*** from Rostock, Germany and Dubna, Russia visited Dr Heidi Reinholz. ***Dr Mark Barton*** from LIGO (Caltech – USA), and ***Dr Conor Lowry***, from ANU visited the Gravity Waves Group. ***Mr Perig Vennetier*** from the University of Paris-Sud, France is undertaking a Research Traineeship in Associate Professor Andre Luiten's Optical Division of the Frequency Standards and Metrology group.

RESEARCH GRANTS

This year the School has already won over $4.5 million in external research grants. This reflects the research intensive nature of the School, in that the operating budget we receive from the University is only $2 million.

ENROLMENTS

In 2004 ***Dr Frank van Kann*** has his hands full coordinating a total of 510 students enrolled in the first year unit Physics 101. This year we have 34 students in second year and 28 in third year. 11 students will complete Honours in Physics and two in Biophysics this year. The School has 36 PhD students in Physics and six in Biophysics.

IN MEMORY OF MS SHIRLEY STRICKLAND AND DR SUSZANNE THWAITES

The School of Physics is deeply saddened by the passing of ***Ms Shirley Strickland*** and ***Dr Suszanne Thwaites***. Ms Strickland graduated from UWA with a Physics degree and went on to lecture and teach. She is known throughout Australia for her gold medal winning performance as a sprinter and hurdler. Dr Thwaites was one of Australia's leading acoustical scientists. She undertook honours at UWA followed by an MSc.

Physics Alumni are invited to email articles to admin@physics.uwa.edu.au for this Newsletter.