The University of Sydney School of Physics

Alumni News

September 2004

Confused about Physics?

The Foundation's recent Science Teachers' Workshop brought together dozens of NSW physics teachers to discuss high-school physics education. One rich vein of debate was the HSC Physics syllabus itself – loud rumblings of discontent have been heard in the classrooms of some NSW high schools, and these have echoed in the halls of a few university physics departments as well.

The strong feelings stem from the dramatic change in the NSW HSC physics syllabus in 2000. While the old syllabus was a fairly 'traditional' physics course, with Newton's laws and standing waves on strings, the new document looks very different, stressing the history and the social impact of science and presenting physics in specific contexts, such as rocket launches, washing machine motors and solar cells.

In late 2003 the Sydney Morning Herald featured two stories about the HSC physics debate, quoting educators on both sides ("Dumbed down physics bores the brightest", Herald, November 1-2; "Physics losing its science, say critics", Herald, November 5). Some teachers decry the lack of mathematical physics in the new syllabus and an over-emphasis on the human aspect at the expense of rigour, which they say is turning off the best students. Other teachers across NSW praise the new syllabus, pointing to growing enrolments and enthusiastic students.

Dr Chris Stewart and Dr Manju Sharma, researchers in the Sydney University Physics Education Research (SUPER) group, are talking to one group of people who ought to have strong opinions about this issue: the students.

2001 was the last year that students taught under the old HSC physics syllabus entered university. That year, all first-year physics students completed a survey in their first week of lectures, asking them how they studied for the physics HSC. It also asked them what, in their opinion, physics is about.

The researchers uncovered some familiar patterns of student attitudes. Amongst the 2001 cohort they found a group who saw physics as a bunch of rules and equations to be memorized. A second group of students thought physics was more of a framework linking all sorts of phenomena together, a way to explain what is going on in the world. This group took a broader approach to studying, reading outside the course notes and seeking to understand concepts rather

continue page 3

In this Issue

Honours to School Members

The University of Sydney often claims the place of Australia's top ranked university in research excellence. There are of course many measures of excellence, one of them being the rate at which scientific papers are cited by other researchers. At the top of that particular ranking is the Prof. David McKenzie from the Applied and Plasma Physics group.

Prof. McKenzie has been named as a 2004 Thomson Institute for Scientific Information (ISI) Citation Laureate. This places him within the top few tenths of a percent of scientists for having his research on materials science regularly cited, a position he has now earned twice in recent years.

Other staff and students of the School of Physics also continue to excel in their various fields and have their work recognised. Prof. McKenzie's colleague in Applied and Plasma Physics, Federation Fellow Prof. Marcela Bilek, was awarded the 2004 Pawsey Medal by the Australian Academy of Science. The Pawsey Medal recognises outstanding contributions to physics by scientists under the age of 40. Prof. Bilek's award is the fourth by a member of the School of Physics in the last decade – an outstanding record.

CUDOS, the Centre for Ultrahigh bandwidth Devices for Optical Systems, is a growing hive of activity in the School and its staff have attracted plaudits as well. Prof. Ben Eggleton, Federation Fellow

continue page 2

Headline

Assoc Prof Brian James

In May the School held two ceremonies to celebrate the success of students studying physics. One was a lunch for honours graduates and their friends and families on the day of their graduation, at which the Australian Institute of Physics (NSW Branch) Prizes for best result in Physics Honours, and the Shiroki Prize for best Honours research report were both presented to Jock McOrist. Jock is now completing a Masters by research in the School prior to taking up a Fulbright Scholarship to enable him to do a PhD at Princeton University. On the other occasion prizes, and scholarships for continuing study of Physics, were presented to students who performed very well in each undergraduate year. Some prizes and scholarships were endowed long ago, but most of the scholarships are funded by the Science Foundation for Physics. Celebrating the successes of our students on such occasions is one of the pleasures of being Head of School.

I am saddened to report the death of alumnus Harry Minnett late last year. Harry, who completed science and engineering degrees at the University of Sydney, worked on radar during the Second World War at the Radiophysics Laboratory in the University grounds. This subsequently became the Radiophysics Division of CSIRO, and it was as a member of this division that Harry was responsible for the design of the Parkes radio telescope. (There is a profile of Harry Minnett in the October 2003 issue of the Alumni News.)

2005 has been designated by the United Nations as the International Year of Physics (IYP) to celebrate physics and its importance in our lives. The significance in choosing 2005 is that it will be the 100th anniversary of the year in which Albert Einstein published three papers of pivotal significance to modern physics, on the topics of the photoelectric effect, Brownian motion, and special relativity. The IYP will be a major theme for the National Congress of the Australian Institute of Physics, to be held in Canberra in January 2005. The School is also planning activities to celebrate and publicise Physics during 2005.

Dr Jenny Nicholls, Executive Officer of the Science Foundation for Physics, has resigned in order to undertake other ventures after nearly fourteen years at the school of Physics. I thank Jenny for her contributions to the smooth operation of the Foundation, and particularly the four International Science Schools she has organised, and wish her well for the future.

Brian James
Head, School of Physics
The University of Sydney

Honours to School Members *continued from page 1*

Paul Steinvurzel

Tom White

and Director of CUDOS, was also awarded a prize for a scientist under 40 – this from the International Commission for Optics (ICO) for his work on non-linear optics and a variety of novel optical fibre devices. Another key member of CUDOS, Prof. Ross McPhedran, was recently awarded the Australian Optical Society Medal which is presented to a researcher at an advanced stage of his career in recognition of sustained and innovative contributions to optics in Australia.

Adding to his list of awards, Prof. Don Melrose gave the Robert Ellery Lectureship during the Astronomical Society of Australia's Annual Scientific meeting in July. The invitation by the ASA to present the Lecture is recognition of his "outstanding contributions in astronomy or related fields".

At the other end of the experience scale, CUDOS postgraduate students Tom White and Paul Steinvurzel have been awarded prizes for their presentations at the recent ACOFT-AOS conference. Darren Engwirda, a third year student working with the Applied and Plasma Physics group, received a similar prize at the Gaseous Electronics Meeting earlier.

Other members of the School to receive recognition in recent times were Michael Breakspear and Kevin Varvell. Dr Breakspear, a member of the School's brain dynamics group received the prestigious AstraZeneca award of the American Psychiatric Association. Dr Varvell was joint recipient of the Sydney University Postgraduate Representative Association award of SUPRA postgraduate teacher of the year for 2003.

Undoubtedly many of our alumni are honoured for work in their own fields. If so, we would love to hear about it.

One recent alumni honour we do know of is the election of Dr Tom Beer, a CSIRO expert in environmental risk, as Vice-President of the International Union of Geodesy and Geophysics.

The New HSC Physics Syllabus:

Further up the Learning Curve

140 senior high school physics teachers attended the 11th biennial Science Teachers' Workshop (STW) on 17 and 18 June 2004. As discussed in the page 1 article "Confused about Physics?", the HSC syllabus was radically changed a few years ago and this STW, like the previous two, concentrated on the new syllabus.

The two days were filled with lectures and small groups sessions, with plenty of time for networking in between. Presenters were urged to provide practical ideas and resources that teachers could implement in the classroom to help them teach more effectively. Emeritus Professor Jak Kelly entertained the participants at the Workshop dinner with anecdotes from his career as a physicist.

The response to the Workshop was very positive with one of the attendees remarking in an email later "It was without doubt the most valuable professional development activity I have been involved with for several years." In filling out the evaluation form at the end of the Workshop, an apparently satisfied customer responded to the question "What should have been left out" with a "No way!"

The School and Foundation sincerely thank all the presenters who gave so freely of their time and experience to make this Workshop a success.

Dr Joe Khachan and Owen Shepherd leading the very popular session on Ideas to Implementation.

Confused about Physics? *continued from page 1*

than just rote-learning facts. In 2001 most students fell into one of these 'reproducing' and 'understanding' groups.

But when Dr Sharma and Dr Stewart surveyed the 2002 cohort – the first lot of students from the new HSC physics syllabus – they found a third group of students whose experiences of HSC physics weren't so easily explained.

About 40% of the first-year students in 2002 said that physics is about disconnected facts and formulas, yet at the same time it is a connected scaffold for understanding the world. They said they study by memorising formulas and ideas, yet at the same time claimed they construct a broad framework of physical concepts. These contradictory ideas seem baffling; the researchers suspect this large group of students were feeling a bit confused about studying physics after the HSC.

Without talking to the students personally it's hard to pinpoint the source of the confusion, but Dr Stewart and Dr Sharma suspect it comes from the chaos that follows major syllabus change.

"You can't change the whole philosophy of a subject and expect everything to be smooth sailing," explains Dr Stewart.
"The teachers need time to figure things out, understand the new assessments, even learn physics they haven't seen before! In the first year, they didn't even have proper textbooks. I wouldn't be surprised if the students were confused about physics after a syllabus change like that."

To test this idea, Dr Stewart and Dr Sharma surveyed first-years again in 2004. By now, they reasoned, teachers should be more comfortable teaching the new syllabus, more resources and support will be available, and so fewer students would leave the HSC with such a confused view of physics.

The 2004 surveys support this view. As before, many physics students seem to be really trying to understand the ideas, and many others seem primed to memorise as much as they can. But the 'confused' group has shrunk by 50% or more, say the researchers. If this result stands up to more analysis, they believe it will improve educators' understanding of the effects of syllabus change and help institutions like the School of Physics prepare for the next time it happens.

No doubt the controversy will continue over what and how physics should be taught in school. In the meantime, the SUPER group will be doing their best to understand what's going on inside their students' heads.

Drs Chris Stewart and Manju Sharma.

Profile: Emeritus Professor Dick Collins

Lots of Scars

Many Alumni, particularly those who graduated over the past 25 years, know Emeritus Professor Dick Collins, himself an alumnus of the School of Physics. Dick was Professor of Applied Physics from 1980 until his retirement at the end of 2000. For the last four of those years, he was Head of School and Director of the Science Foundation for Physics.

Dick Collins

During his 40-year career, Dick published over 100 research papers and several dozen patents. He has also chaired several Australian Government bodies, including ANSTO. He received an Award for Excellence in Teaching from the University in 1994.

Dick has not slowed down in his retirement. Amongst many other activities, he has just completed a book, *Lots of Scars*, which is partly about his professional life, but mostly about other things. Dick recalls his curiosity about the world as a young child and the way that this developed under the guidance of his teachers. He discusses his love affair with his students and how they kept him young. He writes movingly about the challenges faced by his young family when he was an impoverished graduate student in New York. He exposes a few of his idiosyncrasies – experimental cook, experienced handyman, expert cabinet maker, non-expert musician, failed photographer, suicidal sailor, self mutilator, card sharp and some time poet. And he talks about his passions for maintaining friendships around the world, and for his greatest love – his own family.

"What happened next was one of the most extraordinary moments in my teaching career."

Dick will donate all of the proceeds from his book to the Messel Endowment. You can obtain a copy of *Lots of Scars* (autographed by Dick if you wish), and help this worthy cause, by mailing the enclosed Order Form to the Science Foundation.

Here is an extract from the book about Dick's involvement in the Professor Harry Messel International Science School:

At the 1999 School, I would start the first lecture session each day with a greeting that I had introduced to the Scholars at the first lecture: "G'day, mate!" They would enthusiastically respond in unison with the same greeting. All of the Scholars, but particularly those from non-English speaking countries, loved this little piece of Australiana, and I still get letters and emails that begin with these words. On the Saturday evening in the middle of the School, the Scholars, lecturers and sponsors always get together on a cruise... On this particular cruise, some of the kids asked a favour of me. It seems that the Japanese Scholars had brought with them a new word: Oss! The word is delivered with both arms held high.... It seems that the word is used colloquially in Japan when good mates meet. The request was that I should use the word when we met at the first lecture the following Monday. I gave a non-committal response. On the Monday morning, there was an enhanced air of expectancy in the lecture theatre. I brought the Scholars to order and greeted them in the normal way: "G'day, mate!"

The reply thundered back: "G'day, mate!"

Dead silence. Then I raised my arms high and shouted the word: "Oss!"

The reply from 140 excited sets of young vocal chords was deafening: "OSS!"

What happened next was one of the most extraordinary moments in my teaching career.

This group of highly intelligent senior high school students went absolutely ballistic. They screamed, cheered, clapped, whistled, stamped, and pounded the bench in an extraordinary spontaneous outburst of – I know not what – exhilaration, happiness, excitement, gratitude? And this went on... and on... and on.... I have no explanation for this extraordinary event.... The memory of the moment is something that I will always treasure...

Exciting and memorable though the Science Schools have been for me, they were, in a sense, just the cream on the cake of my teaching as an academic...

Profile: Jill Tacon

The Philosophy of Teaching Physics

Today Jill Tacon is the Head of Science at Roseville College – teaching senior physics as well as integrated science in Years 7 to 10. Where did her career in science begin?

Jill Tacon

It was the excitement of science in the 1960s that brought Jill Tacon to the 1963 International Science School. In the last year of high school at Newcastle Girls High, Jill travelled to Sydney for two weeks of science lectures and activities.

Jill recalls the lecturers. "Julius Sumner Miller and Herman Bondi still remain in my mind." In the days of black and white television, the telecast of the lectures were popular viewing. Viewers would have seen Jill and her cohort entranced by the discussion of the competing theories of a steady state universe and the Big Bang; and volunteering to be part of Julius Sumner Miller's 'Why is it so?' investigations.

Was science always her field of interest? "My study could have gone into any area and I remember the choice had to be made between Latin and Physics at the beginning of the senior years at high school. I often wonder what path I would have taken if I had chosen Latin." But the appeal of physics as a challenging subject won out and took her to a BSc at Newcastle University.

Studying Physics, Jill found herself as only one of two women among the 30 or so 3rd Year Physics students and the only woman in 4th year. From there Jill chose teaching, taking a Diploma of Education, and later a Masters of Education. She has taught at a number of public and independent schools.

"I held the tube in the air. But it was February and there were ceiling fans on. I carefully turned the tube over – in the path of the fan!"

Jill has found science teaching to be an interesting path and far from routine. In one class she was demonstrating to students that objects fall at the same rate in a vacuum. She pumped the air out of a glass tube, after placing a marble and a feather inside.

"I held the tube in the air. But it was February and there were ceiling fans on. I carefully turned the tube over – in the path of the fan!" "There was a massive explosion. The class ducked for cover while I tried to hide my shock."

The students later claimed it was the best thing they did, and probably still recall the properties of vacuums (and releasing them!) to this day.

These days, the ads seeking more teachers capitalise on the rewarding nature of teaching. And this has held true for decades, as Jill testifies.

It has led her to the presidency of the Science Teachers' Association of NSW in 2000 and 2001. She has been a senior marker of HSC exams, and has a co-written a current HSC Physics textbook.

Jill encourages her students at every opportunity. "My philosophy of teaching is that I expect more of students than they would normally give – I try to push them beyond their comfort level."

As a result Jill has introduced many challenging programs to her students. Two of the Roseville students represented Australia in the Biology Olympiads, and this year two of her students were the first NSW girls to receive a CSIRO Gold CREST for their scientific research. A number of others have attended the International Science School. Many of her students have pursued careers in Science – "unfortunately only one that I can recall is now a physics teacher."

Jill claims that it is not always easy to predict who will become a teacher and she recalls one student who was often in trouble. "On one such occasion she put a generous amount of sodium in water – an experiment no longer allowed – and her equipment hit the ceiling!" Jill met her again, years later – at a conference for science teaching. The former student was now teaching at a school that was renown for its problematic students, and loving it, despite being the last person Jill would have imagined to end up teaching science.

Between Jill, her husband, who is a pure mathematician, and her two daughters, both doctors, the Tacon family has no shortage of degrees with a scientific background; and clearly a strong interest in learning, as well as teaching.

The Messel Endowment Takes off with a Bang

The Messel Endowment launched its Capital Campaign at the Science Foundation for Physics' 50th Anniversary Dinner held on 5 March 2004 in the Great Hall. The Campaign seeks to raise $3 million over the next three years for the Professor Harry Messel International Science School so it may continue in perpetuity.

The Endowment's Campaign was kick-started into action at the Anniversary Dinner by Emeritus Professor Harry Messel CBE with the surprise announcement that his long time friend and University of Sydney Engineering Alumnus (1964), Mr Lee Ming Tee, had pledged one million dollars to the Campaign. Mr Lee met Professor Messel in the early 1960s when SILLIAC, the first electronic computer in an Australian university, was housed in the basement of the School of Physics. Mr Lee and the Professor struck up a friendship that has endured for over forty years.

Mr Lee Seng Huang, Chairman, Mulpha Australia Limited, presents the Vice-Chancellor, Professor Gavin Brown FAA, with the first instalment of the company's one million dollar gift.

Ms Peggy Yeoh, Mr Lee Seng Huang, Mrs Pearl Lee, Emeritus Professor Harry Messel CBE, Mr Lee Ming Tee, Professor Gavin Brown FAA, and Mr John Hooke CBE at the luncheon held to honour Mulpha Australia Limited's support.

Mr Lee's son, Mr Lee Seng Huang, Chairman of Mulpha Australia Limited, was so impressed when he heard about the ISS that he decided his company would be delighted to support the School and the vision of his father by managing the pledge and in doing so, enable the company to develop an ongoing partnership with the ISS. Mr Lee Seng Huang presented a cheque for $250,000, the first of four such instalments, to the Vice-Chancellor, Professor Gavin Brown, at a presentation held at the School of Physics in April.

Thanking Mulpha Australia Limited and the Lee Family, Mr John Hooke CBE, Chairman of the Messel Endowment Capital Campaign, joked to the audience that the Foundation had obviously learned something in 50 years of philanthropy having launched the Campaign at around nine o'clock and having one million dollars pledged by ten.

The gift will aid the Foundation's biennial Professor Harry Messel International Science School. The ISS, based at the School of Physics, is a free educational program for Year 11 and 12 high school science students from Australia, China, Japan, Malaysia, New Zealand, Singapore, Thailand, the UK and the USA. The Science School, established in 1962, honours excellence and encourages high school students to pursue a career in science and related fields. 3,500 scholars later the ISS has an outstanding reputation as a program that gives future scientists and community leaders the best possible head start.

The Endowment has attracted the attention of the Department of Science, Education and Training which has also given one million dollars to the Campaign as part of the Federal Government's Backing Australia's Ability initiative. The Endowment has also received donations from many individual donors all of who are keen to see the ISS continue in perpetuity. With such generous support from individuals, the corporate and government sectors the Messel Endowment Capital Campaign is certainly off to a flying start.

For more information about the **Messel Endowment** please visit our **website** www.physics.usyd.edu.au/foundation.html and follow the prompts or **telephone** the Executive Officer on +61 2 9351 3622.

The Science Foundation for Physics' 50th Anniversary Dinner: A Personal View

The Science Foundation for Physics celebrated its 50th Anniversary in style with an elegant dinner held in the Great Hall on Friday 5 March 2004. The full details of speakers and many photos are up on the web at www.physics.usyd.edu.au/messel/50dinner.html, and we present here the views of Doug McLeod, ISS1972.

Many people have written to say how much they enjoyed the International Science School (ISS), because they found they were not alone in their academic passions and their brilliance. For myself, as a shy 16 year old, I found it somewhat intimidating to meet so many similar people. Their sharp repartee and obvious intellect threatened my secure niche as the resident mathematics nerd (we didn't have computer nerds in 1972) of Beacon Hill High School. So the ISS was not the pivotal event in my life which it seems to have been in so many others. Nonetheless sheer curiosity impelled my attendance at the reunion. I studied at UNSW so let's see what the avowedly establishment university could turn on for such an occasion. In this I was not disappointed; the dinner was held in a huge, apparently medieval banqueting hall, of stone walls, exposed beams, and even the grotesque faces (corbels) you see at Oxford. It was almost a parody of what you might imagine the University of Sydney to be like; the University was outdoing itself for my benefit. I loved it.

"A few days after the event Harry Messel was asked if he had enjoyed the dinner. He replied, "I've never seen the Great Hall so packed. It was a bloody fantastic experience."

Surprisingly enough, no-one else from my year attended, and I was on a table with people from the year above and the year below. And it was just like 1972. You couldn't slip a facile observation or a commonplace past these guys. They would pounce on it in a shot. And they thought about things, they had their own theories. Not silly theories either, but well thought out proposals which sometimes went beyond my own thought on the subject. But this time around, being more confident, or at least more drunk, I enjoyed it. I found I was having a seriously good time, in fact everyone on the table was. In the intervening years I have worked at universities, Commonwealth Treasury, investment banks overseas, been to conferences, but the atmosphere was still rather special. Probably because we had not met before and would not meet again, everyone felt free to rave without inhibition, like 16 year olds indeed. Why, they remembered Jethro Tull and everything. Even the speeches seemed to be interesting, as far as I could tell without listening.

It is nonetheless necessary to record two negative observations of a more political nature. Firstly, all but two on our table were either doctors or lawyers. Where are the engineers, architects, scientists and businesspeople? Channeling all our intellectual firepower into these two professions does nothing for Australia's economic development, or allow us to contribute to the rest of the world. Secondly, some of the politicians who were involved received more recognition and deference than the distinguished scientists. One of them even got to give a speech. Why? This was one time, the 50th Anniversary of the Science Foundation for Physics, when they should have taken a back seat. How can the essentially humble achievements of these people be given priority over the scientists present? With this kind of cultural cringe, no wonder our brightest intellects are not attracted to science. You would not see it in the USA, or a meeting of the Law Society of NSW for that matter.

Now to those who think these observations are out of place, I can only say that this kind of high-blown philosophizing was completely typical of the night. It was great. Many thanks to the School of Physics and the organisers, and bring on the 60th reunion.

Doug McLeod, ISS 1972
PS I even got to shake Harry Messel's hand!

From left, Ruth Wilkinson-Pritchard (ISS1971), Glynn Gill (ISS1973) and Deborah Porteous at the ISS 1971-1973 table (photo courtesy Doug McLeod).

Where are you now?

Alumni report on themselves

International Science School Alumni
(The State/country the person represented at the International Science School, and the year of the School are given in brackets after each person's name.)

George Griziotis
(NSW ISS1977, BSc(Hons) 1984)

Inspired by the words of Professors Julius Sumner Miller and Harry Messel, and comforted by friendships with fellow students from as far away as Port Lincoln and New Zealand, my impressionable mind was drawn to the world of crocodile tracking methodology, being the theme for that year's ISS, and orchards, despite the occasional chess game diversion. In the days when the ISS was broadcast (delayed) on TV, little opportunity was lost to ask questions for our intellectual nourishment and desire to see ourselves on TV. The ISS stimulated our appetite for science and our appreciation of the benefits its practical application may bring.

My subsequent degree in Genetics (molecular) equipped me for my career as a Patent Attorney, specialising in recombinant DNA technology, which I now juggle with a part time lecturing position in intellectual property law (Masters level) at UTS.

School of Physics Alumni
(A year after the degree indicates a Sydney University degree.)

We welcome contributions to this column

Patricia Eve Lietmeyer
(nee Mautner, BSc 1975)

After having completed my BSc, I went to Germany to continue studying Maths and Physics, graduating as "Diplom-Mathematiker" in 1978. I married and stayed in Germany and have little time for work with a family of 6 children. For the past 15 years I have nonetheless been working part-time as a software developer, recently mainly programming in Visual C++, and have also translated a book on the subject. Visits to Australia are rare but I am very happy to welcome visitors from Australia here. Living between Bonn and Cologne, we are very central in Europe.

Colin Mathers
(BSc 1975, PhD 1979)

Colin Mathers switched from physics to epidemiology and population health. He moved to the World Health Organisation in Geneva in 2000, where he is now responsible for analysis and reporting on global mortality and the burden of disease. He has two teenage daughters in Australia and a baby son born in 2003.

Dr Karl at large

Dr Karl's Handy Teaching Tips

Dr Karl in action at the 50th Anniversary Dinner.

I speak, on average, to about around four or so school groups a month. When I put a talk together for a school group, I tend to mix the more serious science in with some fun science – this way the students don't notice as much that they've just taken in some fairly heavy duty scientific concepts. Sneaking in the science, so that the students learn without noticing, is a favourite approach of mine. Hopefully over time I can keep perfecting the recipe.

Cheerio, Dr Karl.

Contact Details
Alumni News Editor Dr Jenny Nicholls **Contributors** Dick Collins, Doug McLeod, John O'Byrne, Owen Shepherd, Chris Stewart and Alison Thorn.
School of Physics Alumni Dr John O'Byrne email j.obyrne@physics.usyd.edu.au Phone +61 2 9351 3184 Fax +61 2 9351 7726
International Science School Alumni The Executive Officer email scifound@physics.usyd.edu.au Phone +61 2 9351 3622 Fax +61 2 9351 7726
Postal Addresss School of Physics A28, The University of Sydney NSW 20056 Australia web site http://www.physics.usyd.edu.au

TAN9932 07/04