10 YEARS

OF

UWS COMMUNITY

ENGAGEMENT

DR RAGBIR BHATHAL

ENGINEERNG

SCHOOL OF COMPUTING, ENGINEERING AND MATHEMATICS

UNIVERSITY OF WESTERN SYDNEY

&

VISITING FELLOW

RESEARCH SCHOOL FOR ASTRONOY AND ASTROPHYSICS

AUSTRALIAN NATIONAL UNIVERSITY

CONTENT

INTRODUCTION

Professor Janice Reid, Vice-Chancellor, UWS

In the last couple of weeks the Vice-Chancellor has called for nominations for UWS Excellence Awards in Community Engagement.

I am not applying for any of these awards as I believe there are many members of the UWS community who are doing brilliant things in engaging the public with UWS. They are the silent little people like me who do these things because they are worthwhile. We also do these things because we feel we need to give back to the community what the community gave us.

The purpose of my sending this document to you is to let you know how one person in UWS has been involved in community engagement for the last ten years. This serves as an example of how many other silent academics have given their time to serve UWS and the community of which it is a part of.

I have been involved in a diverse program of activities which include writing books for the intelligent lay public and scholars, an engineering and astronomy program for Indigenous students, the Engineering & Medicine Experience for Year 9/10 students in NSW schools, Engineering Frontiers program (this is a new initiative) and the NASA Science Camp, Earth Hour and the heritage listing of the night sky over NSW, Astronomy Nights for the public and schools, Public lectures both in Australia and overseas, seminars on astronomy education and popularisation of astronomy to the public, giving media interviews and appearing on national radio and TV.

As evidence of the above I have attached a selection of news reports of my involvement over the last ten years in community engagement.

There have been several benefits to the community. The community sees the University as a good corporate citizen. The programs have brought to the public the latest advances in science and engineering. It has involved the students in schools in the region in science and engineering and raised their aspirations to study at the university level.

Dr Ragbir Bhathal

30 September 2013

PROFILE

A profile of some aspects of my work was written by senior science journalist, Leigh Dayton in the Weekend Australian. In the US, well known science and technology journalist, Bruce Dorminey wrote an article on my search for nanosecond laser pulses from outer space for the international business magazine FORBES which has a world wide circulation of 1 million copies. In the article he also mentioned well known and high ranking US and Canadian universities, such as the University of California (Berkeley), Harvard University, Rice University and McGill University which are carrying out a similar search. Another article on my work appeared in the Australasian Science magazine.

The Australian Optical SETI (OZ OSETI) Project has been conducted by me over the last ten years at the Campbelltown Rotary Observatory which is the only privately funded observatory in any university in Australia. The OZ OSETI Project is the only dedicated project to search for ET in the optical spectrum in the Southern Hemisphere. It is well recognised in international astronomical (SETI) circles.

THE FACE

LEIGH DAYTON meets
RAGBIR BHATHAL
Astrophysicist, author, polymath

Picture: Bob Finlayson

RAGBIR Bhathal's calling card reads "Astrophysicist". But it could easily read teacher, quester, antiquarian, historian or author. That's because like any good polymath, the University of Western Sydney academic is a jack of all trades and a master of, well, all of them.

Case in point: *Australian Backyard Astronomy*, the latest of his 15 books and more than 100 research papers. It's a glorious look at the southern sky, for southern eyes, through southern eyes, be they ethnically European, Aboriginal or Asian. That it's the work of an astrophysicist is no surprise. But an antiquarian?

Take a look at the exquisite star charts he uses to illustrate the book, from Hendrik Hondius's zodiac and Johannes van Loon's celestial map, both from the 17th century, to Rudolf Wetstein's 18th-century map of the globe.

These and others are held by the National Library of Australia, publisher of the book, which is co-authored by Bhathal's daughter Jenny, an expert in public health.

"When Jenny was young we would go out and look at the night sky," Bhathal says, explaining the father-daughter collaboration. "She drew some of the original diagrams in the book. My wife did the criticism," he adds with a laugh.

Historian? Bhathal's enthusiasm for the origin and evolution of science and technology seeps through his book.

He tells tales of how people from different ages and places named stars and interpreted constellations and how generations of professional sky watchers have developed ever more precise ways of exploring the light, dark and exceedingly mysterious bits of the firmament.

Those technological advances have made possible Bhathal's personal search for extraterrestrial intelligence, or SETI to the cognoscenti. From his observatory at the UWS Kingswood campus in Penrith, "quester" Bhathal is searching for laser signals transmitted by ET.

His is the only dedicated optical SETI search in the southern hemisphere and Bhathal fills his readers in on it, along with the history of quests for cosmic company. He does so beautifully, talking neither up nor down to readers. It's obvious he is a born teacher. "I just like teaching," he admits.

Of course, Bhathal never really had a chance. "All four of my sisters are teachers." Given four such compelling forces, it's little wonder that once he graduated from secondary school and university in Singapore — where Bhathal had moved from his native Malaysia — he chose to study teaching at Britain's University of Birmingham: "It was still the colonial era."

After about a month in the classroom, Bhathal felt the combined attraction of two powerful forces. Force one was a love of physics acquired as the Isaac Newton-worshipping, moon-watching third son of a police chief turned businessman. He transferred to the University of Queensland where he fell under the influence of the second powerful force: now retired University of Queensland geophysicist Frank Stacey, "a remarkable person".

"He was one of the best minds in Australia and a wonderful mentor," recalls Bhathal, who went on to earn a doctorate in geophysics under Stacey's tutelage.

As a newly minted geophysicist, Bhathal shuttled between Singapore and Sydney, first landing at the University of Singapore. While there, Toh Chin Chye, the then minister of science and technology and deputy prime minister, asked him to take up the directorship of the new Singapore Science Centre. "I didn't even apply," Bhathal says, a note of amazement still in his voice. "His secretary rang me at the university and said the minister would like to see me. I wondered, 'Have I done something wrong?' It turned out quite well."

Indeed it did. It was 1973, a time when few children in Singapore were studying science and technology. That meant Bhathal was pushed to pull together all his educational and academic expertise to help power the transformation of the city-state into the burgeoning tech centre it has now become.

The eclectic style he developed is exemplified by the fact that while the multifaceted Bhathal also held influential positions with organisations such as the Singapore National Academy of Science and the Science Council of Singapore, he nonetheless found the time to set up the Singapore Society of Science Writers.

His Singapore experience made Bhathal a natural for his next position, a member of the management team that gave birth to the Powerhouse Museum in Sydney. He headed the science and technology division and oversaw the restoration of the Sydney Observatory.

The jump from Powerhouse manager to powerhouse astronomer was, of course, written in the stars. In this happy conjunction of research, teaching and writing, the peripatetic Bhathal finally found his true home.

CLOSE-UP

Big break: Being asked by Singapore's science minister to run the Singapore Science Centre.

Career highlight: Publication of *Australian Astronomers: Achievements at the Frontiers of Astronomy* in 1996 and *Profiles: Australian Women Scientists* in 1998.

Lowlight: Having a scientific paper on the search for extraterrestrial intelligence rejected by the journal *Nature*.

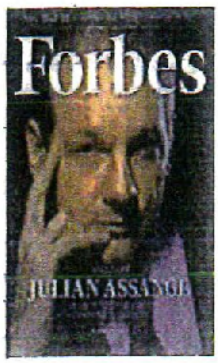
Favourite scientist: Isaac Newton.

Guilty pleasure: Ice cream, lots and lots of ice cream.

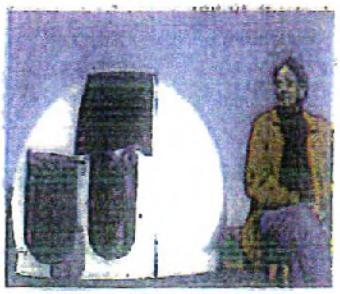
He especially enjoys the public astronomy nights he runs. "Hundreds of people turn up, mums and dads and kids. They're all curious and ask all sorts of questions. How do stars form? What are stars? What are galaxies? How far away are some of these stars? Many of them asked why there are no [popular] astronomy books by Australian authors."

There's one now.

Aliens With Lasers: SETI Bets On Nano-second Flashes From E.T.



Nearly four years ago, a tiny optical observatory in a remote Sydney suburb created a minor-news flap after potentially detecting an intelligent laser signal from the direction of 47 Tucaffae – a truly ancient globular cluster of some 35,000 stars in the southern constellation of Tucanae.



Dr. Ragbir Bhathal at the Australian Optical SETI Project, Rotary Observatory, at the University of Western Sydney (UWS) Campbelltown. Credit: Luke Fuda, Camden Advertiser (Fairfax Media)

Living The Interstellar Sci-Fi Future: Next Stop Proxima Centauri?

Bruce Dorminey Contributor

Nanotech Goes Country: MEMS Chips To Measure Water Stress Down On The Farm

"We were doing the normal run on our 0.4 meter (16 in.) Telescope in December 2008 and found this spike on our computer screen," said astrophysicist Ragbir Bhathal, Director of the Australian Optical SETI Project at the University of Western Sydney Campbelltown. "It was quite exciting to see this very sharp signal and I wrote on the print-out "Is it E.T.?"

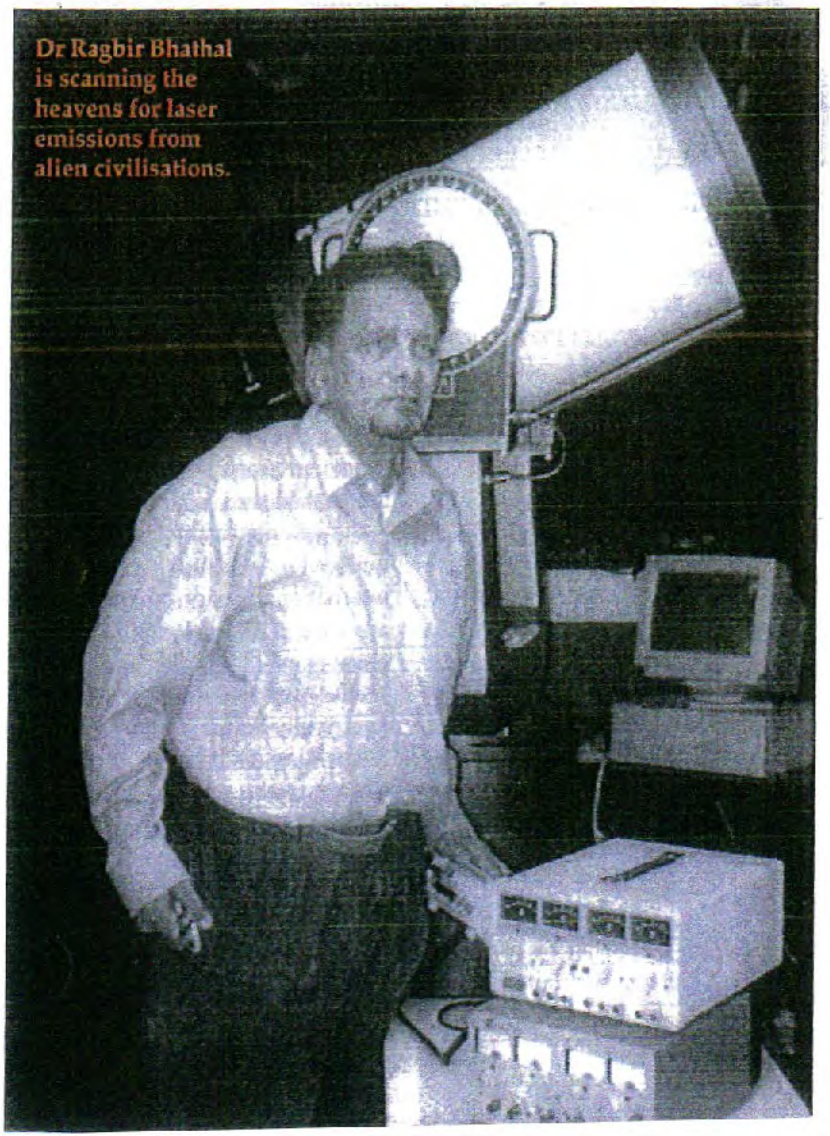
But alas, No. Although Bhathal said there was no fault with the instruments; six months of trying to relocate the signal turned up nothing. "We have now dismissed it as spurious," said Bhathal, who notes that instead of an intelligent signal from E.T., the spike was most likely caused by wayward cosmic rays.

After 50 years of searching the skies for E.T. in the radio spectrum, SETI (Search for Extraterrestrial Intelligence) astronomers are finally taking Optical SETI to whole new levels.

FORBES INTERNATIONAL MAGAZINE WITH CIRCULATION OF 1 MILLION WORLD WIDE

Laser Search for Extraterrestrials

DAVID DAVIDS speaks to Ragbir Bhathal about a new approach to communicating with alien civilisations.



Dr Ragbir Bhathal is scanning the heavens for laser emissions from alien civilisations.

After almost 40 years of fruitless endeavour, no great or small radio signals from extraterrestrial intelligence (ETI) have been found. The Universe appears silent even though instruments literally billions of times more powerful than Frank Drake's primitive one-channel radio telescope have come online.

Drake was the first scientist to carry out a search for ETI with a radio telescope in 1960. His predictions that we would find ETI by the 1980s have not been realised and he has had on more than one occasion to revise his estimates for a successful detection. The reality is that the ETI search is a cosmic enterprise and we may not know that ETI exist for several more decades.

This has not stopped a new group of "young Turks" in the US and Australia from expanding the search to the optical region of the electromagnetic spectrum. The US effort includes Prof Paul Horowitz from Harvard University, Dr Dan Werthimer from the University of California and Dr Stuart Kingsley from the Columbus Optical SETI Observatory, while the Australian effort is led by Dr Ragbir Bhathal from the University of Western Sydney.

Bhathal's experiment is the only one in the Southern Hemisphere and also one of the most sensitive in the world. According to Bhathal, an award-winning author and astrophysicist: "If ETI are out there they would have surpassed the radio threshold and gone on to communicate with other intergalactic civilisations by laser pulses. Light waves carry hundreds and thousands of times more information than radio waves."

The Universe may well be radio-silent. If this is true, radio search strategies are in for a big surprise and all the well-laid plans for the construction of a large telescope array may come to nought.

SETI first caught Bhathal's interest when he read Drake's 1960 article on Project Ozma in the American journal *Physics Today*. Being too busy "earning my PhD and doing real physics," he did not give SETI much thought. He was more interested in working on Nobel Prize winner Louis Neel's theories on magnetism. His PhD days at the University of Queensland were "exciting times". His PhD supervisor was Prof Frank Stacey, a Fellow of the Australian Academy of Science and the first recipient of the Neel Medal. He set the physics community agog with his ideas on the existence of a fifth force, but several years of searching failed to find it.

Bhathal's interest in SETI was revived in 1996 when, out of curiosity, he attended a bioastronomy conference in Capri and heard the inventor of the laser and Nobel Prize winner, Charles Townes, talk about optical SETI and the possibility of ETI using lasers for intergalactic communication. Most of the participants were sceptical about what Townes was telling them and did not take him very seriously, but Bhathal was sufficiently impressed with Townes' talk. On returning home to Sydney he began his own investigations.

He was surprised to find that not much work had been done in optical SETI. He organised an international conference on *SETI and Society* at the University of Western Sydney in 1998 and launched his own optical SETI project.

The idea of optical SETI is not new. In the 19th century the European mathematician Karl Gauss proposed the use of mirrors to send light messages to aliens on the Moon. He remarked that if we could get in contact with the aliens on the Moon "it would be a discovery greater than that of America".

Graham Bell, the inventor of the telephone, had in fact used a light beam to transmit messages. Called the photophone, he said that it was his greatest invention. However, since he used ordinary light it suffered from dispersion and scattering in the atmosphere and never saw the light of day.

The invention of the laser by Charles Townes in the 1960s provided an extremely narrow and sharp beam. This property of the laser threw open the possibility of using lasers to communicate. This led Schwartz and Townes to suggest in a long-forgotten article in *Nature* that lasers could be used for interstellar communication rather than radio waves. The idea did not get off the ground because in the 1960s lasers were considered novelties and their power was small.

"If ETI are out there they would have surpassed the radio threshold and gone on to communicate with other intergalactic civilisations by laser pulses. Light waves carry hundreds and thousands of times more information than radio waves."

In contrast radio technology, which had a head start of several decades, was relatively mature. Thus, the scientific community concentrated the search for ETI in the radio region of the electromagnetic spectrum, especially at the special emission frequency (1.4 gigahertz) of neutral atomic hydrogen – called the "21 cm line" after its wavelength.

In February 2001, Bhathal published an article in the British journal *Astronomy & Geophysics* in which he made a case for carrying out optical SETI. He said that "a Moore's Law doubling of laser technology over the last 40 years has seen laser power rise exponentially from the milliWatt lasers used in undergraduate laboratories to megaWatt lasers in industry". For instance, the National Ignition Facility in the US has produced laser powers in the terraWatt range (10^{12} Watts), albeit for short periods. These developments, Bhathal argued, give tremendous credence to the search for ETI signals in the form of nanosecond laser pulses.

We already have the technology that can produce extremely short laser pulses of petaWatts (10^{15} Watts). If one couples this to a large optical telescope like the 10-metre Keck, which is used like a searchlight mirror, we have an efficient system of directing nanosecond laser pulses at other interstellar civilisations.

Laser light produced like this and directed towards the solar system would easily outshine the light from the star from which the light originated. According to Bhathal, the nanosecond laser pulse would appear about 5000–7000 times brighter than the background light from the ETI star. This fact is independent of distance, since both the laser light and the light from the ETI star will diminish at about the same rate with distance.

The other advantage, according to Bhathal, is that no magic frequencies are involved in an optical search, unlike the radio search at the 21 cm line. "We don't have to guess the ETI laser wavelength," he said. The stark difference between signal and starlight will show up in any search that uses a broadband "white light" detector, such as a photomultiplier tube.

There are a number of other reasons for searching for ETI signals in the optical region. It is well-known from observations that the ionised hydrogen in interstellar medium causes smearing and degradation of transmitted radio signals. While dispersion broadens radio pulses, it is negligible at optical frequencies. The transmitted beams from optical tele-

Features

scopes are sharper and narrower than their radio counterparts.

The discovery of several other lines of astronomical interest led Townes to question the superiority of the 21 cm line as the only wavelength at which ETI will be transmitting signals. Kingsley further questioned the almost religious use of the 21 cm line as the favoured search frequency.

Together with Bhathal, Kingsley organised an international conference on optical SETI in January 2001. It was held in Silicon Valley, America's centre of new and exciting ideas and endeavours. Attended by more than 100 SETI researchers and keynoted by Townes, it marked the rise of optical SETI as a major new force in the search for ETI.

One of the great advantages of doing optical SETI, according to Bhathal, is that "it does not require complicated equipment and computational power as compared with the radio search". All that is required is a pair of extremely fast photon-counting detectors wired up in coincidence mode. This is similar to the coincidence techniques used in nuclear physics, where two detectors send an alert when they receive a signal at exactly the same moment. Very fast photon-counters have come on the market only recently, enabling optical SETI to take off.

Bhathal's search strategy is to look for nanosecond laser pulses within a volume of 100 light years. These are likely to be deliberate signals from ETI to us, rather than "noise" generated by an advanced civilisation communicating with itself.

There are about 1000 stars within Bhathal's search range. Assuming that an ETI civilisation targets one star after another and fires a laser pulse at perhaps 10 stars per second, then this civilisation could hit all Sun-like stars every 100 seconds. Bhathal thus spends a few minutes on each star and revisits the stars on his nightly run.

He has designed very fast and extremely sensitive detector systems that he attaches to two telescopes separated by a few metres at his OZ OSETI observatory at the University of Western Sydney in Campbelltown, a semi-rural suburb about 60 km from the heart of Sydney. Bhathal says that "most Campbelltownians switch off their lights and are asleep by 10 pm, thus leaving the night sky quite dark". Even so, light pollution does not cause a problem with optical SETI. In fact, Kingsley says that optical SETI can be carried out during the day with suitable filters.

In Bhathal's set-up, light from the telescopes is split by beam-splitters and falls on very fast photomultiplier tubes wired in coincidence mode to reject any false signals. He uses two telescopes to ensure that the system is not bugged by false hits during an observation run. His system is different from that of his American counterparts and is much more sensitive to ETI signals. By keeping track of the light flash intensity when the paired detectors respond simultaneously, it is possible to know whether ETI has sent a signal. Distant lightning flashes or static electricity or other extraneous fast flashes of light do not pose a problem for Bhathal's detector system since these flashes are not in the nanosecond range.

After almost a year's observations of 100 Sun-like stars and 15 globular clusters, no evidence of intentional laser signals have been found. So what are his plans for the future? Bhathal says he will continue to monitor another 2000 stars, 30 globular clusters and a few galaxies. He has also drawn up plans for the construction of a 1-metre dedicated optical SETI telescope to carry out an all-sky survey. The wide-field telescope will carry out a meridian transit survey in which the night sky will drift through the field of view of his stationary telescope. "The telescope will be used as a light bucket and it will not need to be highly accurate," he said. "A few arcminutes would be sufficient for the purposes of the project." The whole southern sky would be covered in about 250 clear nights.

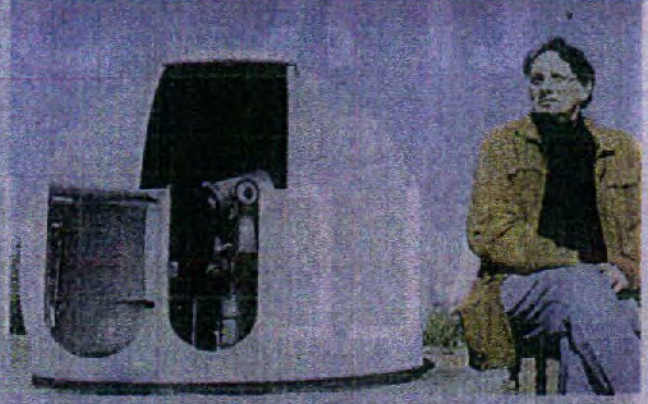
In case he does discover a signal he has a bottle of champagne in his observatory to celebrate the event.

David Davids is a technology and industry consultant and a science writer. He holds PhDs in astronomy and management.

Waiting for ET's call

By **Iliana Stillitano**

A JOB LESS ORDINARY



The truth is out there: Astrophysicist Ragbir Bhathal is on a search for extraterrestrial life. Pictured at the University of Western Sydney Macarthur's observatory, Dr Bhathal said equipment designed to search for nanosecond laser pulses that detect extraterrestrial intelligence are becoming more sophisticated and he is certain a discovery will be made in the near future. **Picture: Luke Fuda**

AS a young boy, Ragbir Bhathal was captivated by the stars and the moon in the night sky.

Like FBI agent Fox Mulder, a young Dr Bhathal spent many nights wondering whether there was life outside the world he knew.

So it's not surprising that years later, Dr Bhathal dedicates his time to searching for extraterrestrial life.

He founded the Searching for Extraterrestrial Intelligence Australia Centre at the University of Western Sydney Macarthur and taught the only university-based course on the subject in Australia.

While that course is no longer offered, Dr Bhathal continues his search for the existence of extraterrestrial life and is writing a book called *The Search of the Century*.

The book explains what is involved in searching for microbial life, searching for Earth-like planets and the implications of discovering that there is life elsewhere in the universe.

"The discovery of a message from extraterrestrial intelligence will be a discovery greater than the discovery of America by Christopher Columbus," Dr Bhathal said.

So big in fact that Dr Bhathal keeps a bottle of champagne in his office ready to celebrate the momentous occasion.

"It would be like cracking the jackpot," he said.

Dr Bhathal counts himself fortunate that his job is also his hobby.

"It's one of the most exciting jobs in science," he said.

From the response he has received from his many books on astronomy, it seems others would agree.

Australian Backyard Astronomy was written to "fire the imagination" of young people by encouraging them to identify constellations from their backyard. It sold out after three months and was reprinted.

Another book on Australian astronomers and their achievements made the best-sellers list..

"People are very curious, particularly kids," he said.

"I'm still surprised when I hear people say they haven't seen the moon through a telescope.

"When you look through a telescope you can see craters in the moon and that's a real wow factor for kids.

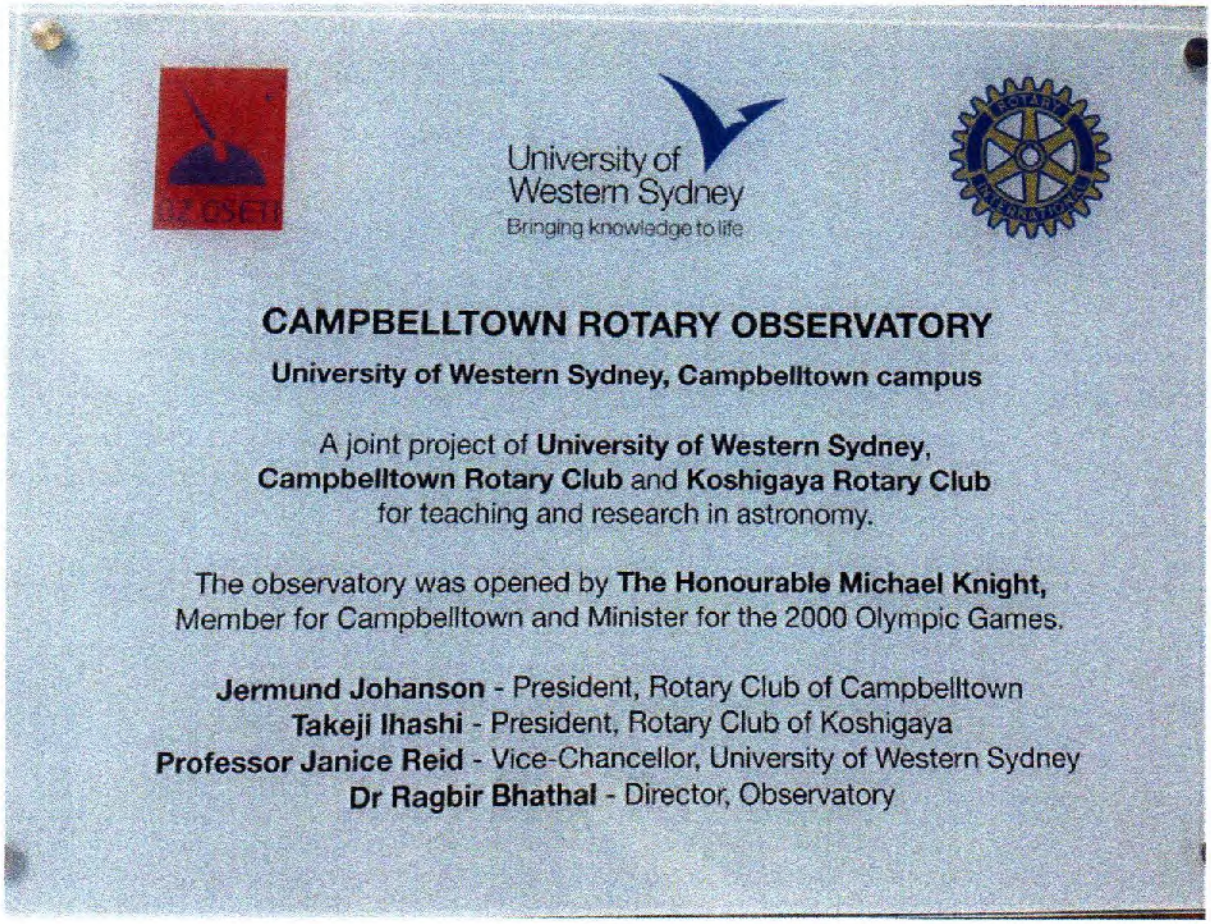
"My word, you have to see them."

CAMPBELLTOWN ROTARY OBSERVATORY

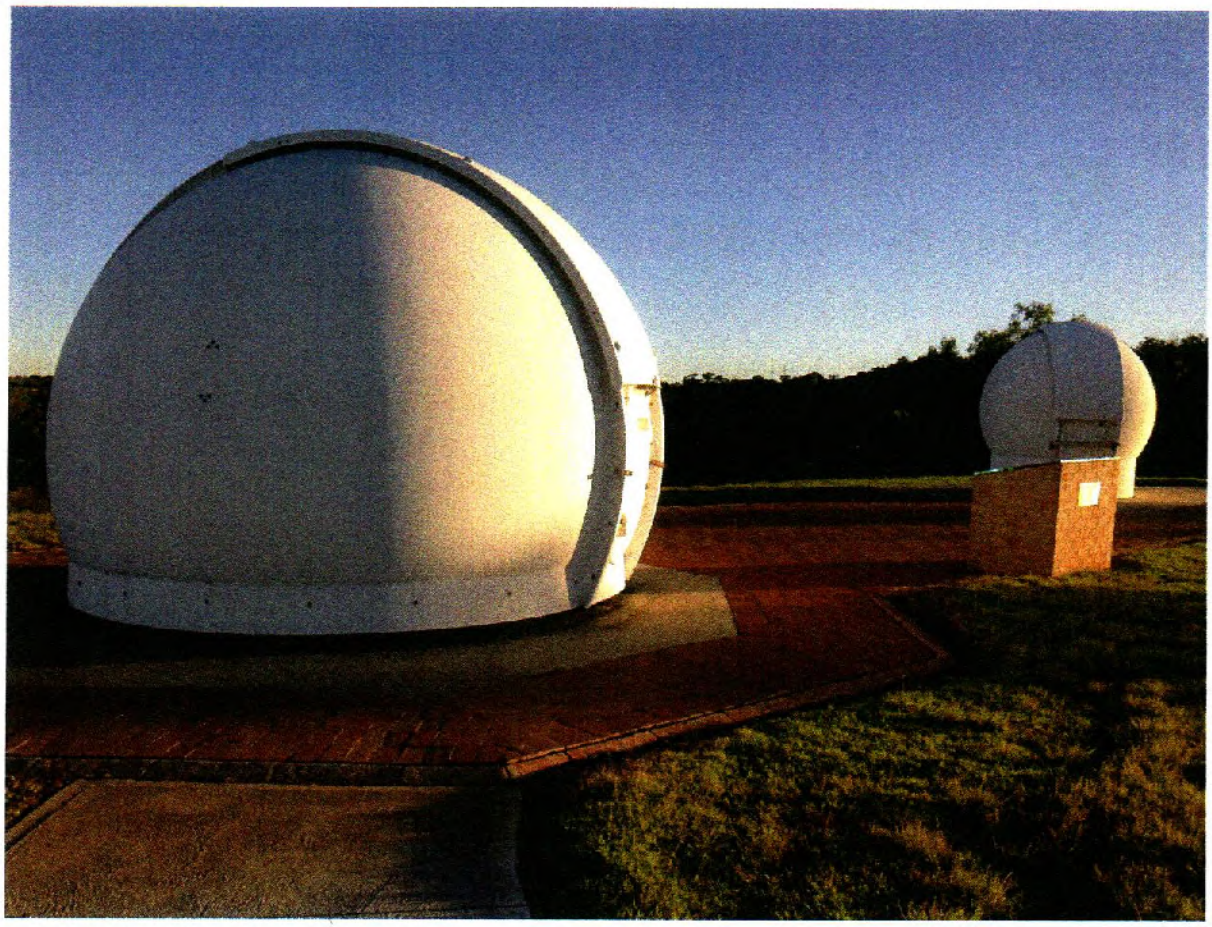
Campbelltown Rotary Observatory was single-handedly designed and built by me to conduct one of the most exciting projects in astrophysics, that is, the search for Extraterrestrial Intelligence using optical telescopes. The telescopes are searching for extremely fast nanosecond laser pulses with sophisticated equipment. Similar projects are being conducted in the US at Harvard University, Princeton University, University of California (Berkeley) and the SETI Institute. Japanese universities are now also involved in this project. The Australian Optical SET Projected which is conducted at the Campbelltown Observatory is listed in the world list of observatories which are conducting the optical search for ET.

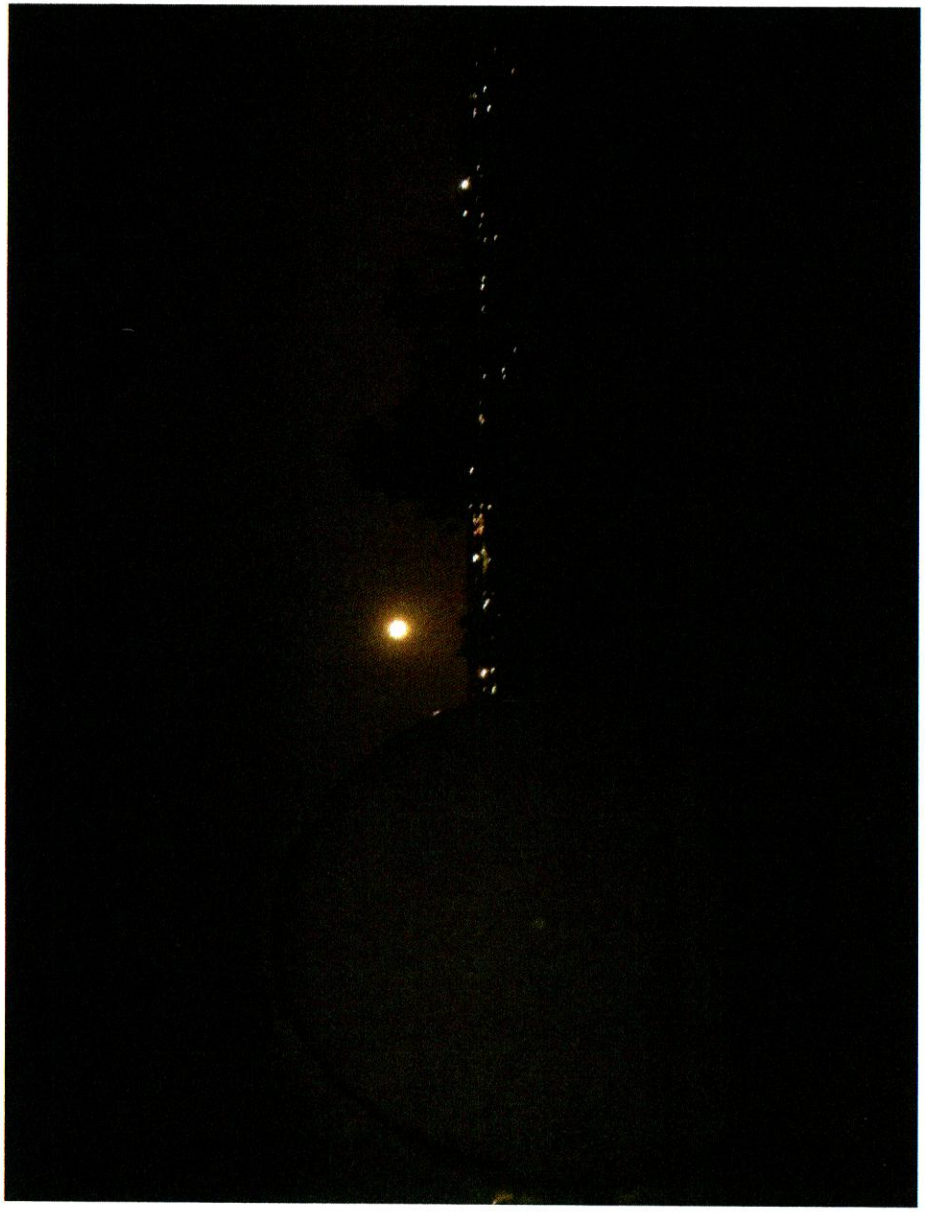
The major funding for the Campbelltown Rotary Observatory came from the private sector in the Campbelltown and the Macarthur areas. The Rotary Clubs of Campbelltown and the Japanese Koshigaya Rotary Club were also involved in the funding of this Observatory. The Campbelltown City Council gave in kind support for the project.

Apart from the research program, the Observatory has been running astronomy nights for the public and the schools. Over 35,000 members of the public have participated in the Observatory's programs in the last ten years. The astronomy nights and the public lectures have built a very strong relationship between the members of the public and UWS. It has also generated a tremendous amount of goodwill towards the university which no amount of money can purchase. The citizens of Campbelltown see the Observatory as belonging to them. It is a public observatory and it is hoped it will remain that way well into the future. All the activities conducted at the Observatory for the public are free of charge. The Observatory has run on a no loss basis.


University of
Western Sydney
Bringing knowledge to life
ROTARY
INTERNATIONAL
CAMPBELLTOWN ROTARY OBSERVATORY
University of Western Sydney, Campbelltown campus
A joint project of University of Western Sydney,
Campbelltown Rotary Club and Koshigaya Rotary Club
for teaching and research in astronomy.
The observatory was opened by The Honourable Michael Knight,
Member for Campbelltown and Minister for the 2000 Olympic Games.
Jermund Johanson - President, Rotary Club of Campbelltown
Takeji Ihashi - President, Rotary Club of Koshigaya
Professor Janice Reid - Vice-Chancellor, University of Western Sydney
Dr Ragbir Bhathal - Director, Observatory


FROM THIS SITE
THE FIRST OSETI SEARCH
WAS CONDUCTED BY
DR RAGBIR BHATHAL
IN YEAR 2000





Flash in the pan may be messages from outer space

Richard Macey

A Sydney astronomer is watching the skies for aliens he suspects may be flashing at us.

Since 1960, scientists involved in the now international Search for Extraterrestrial Intelligence (SETI) have been using radio-telescopes to listen for signals that will tell us we are not alone.

But so far the hunt has been fruitless, turning up just occasional false alarms triggered by stray radio interference from man-made gadgets.

An astrophysicist at the Campbelltown campus of the University of Western Sydney, Dr Ragbir Bhathal, believes the problem is that alien civilisations may be so advanced they have abandoned radio in favour of more sophisticated forms of communication.

"On Earth, we are already moving away from communicating by radio to optical communication with fibre optics and lasers," he said. "By 2050 most of our communications will use light which can carry hundreds of thousands of times more information than a radio signal."

He said that during US President Reagan's failed Star Wars military program of the 1980s scientists designed high energy lasers which could produce nanosecond light pulses.

Studies showed that pulses from extremely powerful lasers placed 100 to 1,000 light years away could be easily detected by a telescope and sensitive detectors. "The flashes would outshine a sun-like star," said Dr Bhathal, who believes aliens could already be using lasers to signal their position.

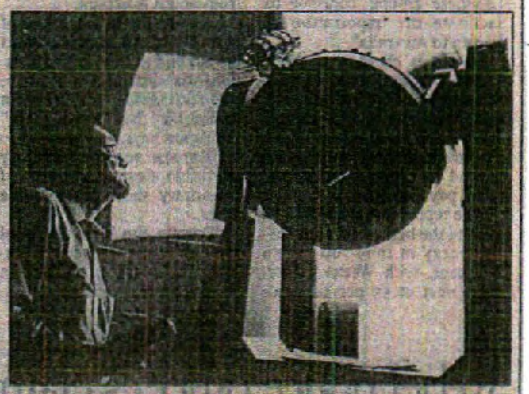
So, whenever Campbelltown's nights are clear, Dr Bhathal, director of the Australian Optical SETI project, or Oz Oseti, is in the university observatory using its twin telescopes to scan the skies for flashing stars.

He has chosen 200 sun-like stars within 100 light years of Earth to watch. He spends up to five hours a night, observing from five to 10 stars. "So far we have looked at 20 stars," he said. "We haven't found anything at all." He hopes to have examined all 200 within six months, before expanding his search to include 10,000 stars out to 1,000 light years.

He was confident any light signal should be unmistakable. If one telescope spots a flash he will check what the second saw. If both record a flash he will be confident it was a real event, not a technical glitch.

Dr Bhathal believes intelligent civilisations must be out there, despite being hard to find. "Look at how many millions of stars there are in the universe. It is unreasonable to expect there is no life on any of them."

Even if he spots a flashing star, he has no plans to flash back. "It's a search strategy," he said. "Not a reply strategy."



Dr Bhathal watches and waits for a sign. Photo: Laura Friezer

The Sydney Morning Herald | News 7 | Wednesday, March 7, 2001

NEWS WATCH

BRINGING NEWS ABOUT PROMINENT AUSTRALIANS

BOOKS FOR THE PUBLIC AND SCHOLARS

I have written 16 books on science for the public and scholars. Ten of these books are on astronomy and astrophysics. They are part of my reaching out not only to the community in the Western suburbs of Sydney but also to the wider Australian community across Australia.

Aboriginal Astronomy: This books details 40,000 years of Aboriginal social-cultural astronomy. It was well received by the Aboriginal community. It illustrated that the Aboriginal people of Australia were also observing the night sky for thousands of years just as the other ancient peoples of the world.

Selected documents in Aboriginal Astronomy: This documents the papers that were published by scholars on Aboriginal astronomy from the 19th century to the 1940s. It is similar in spirit to Manning Clarke's book on Documents on Australian History.

Under the Southern Cross: This was the first book that was written on the history and development of astronomy in Australia from the Dreamtime to the 1990s.

Australian Astronomer - John Tebbutt: This book deals with the life and scientific achievements of Australia's most famous 19th century astronomer. He discovered two of the great comets of the 19th century and has a crater named after him on the Moon.

Australian Astronomers: Published by the National Library of Australia it deals with the scientific achievements of 18 of Australia's top astronomers who are internationally recognised in the field of astrophysics.

Astronomy for the Higher School Certificate: This book was written for HSC students and teachers as there were no suitable astronomy books at this level. It served a crying need for a suitable textbook on HSC astronomy. HSC astronomy is part of the HSC physics syllabus.

Searching for ET: This book deals with the latest developments in the search for extra-terrestrial life in the universe.

Australian Backyard Astronomy and Rockets into Space: At the request of the National Library I wrote these two children's books to encourage young boys and girls to take an interest in science. The books have turned out to be very popular with children and parents.

University Physics with Mastering Physics: With two American physicists, Hugh Young and Roger Freedman I wrote *University Physics* which is used in teaching first year physics to physics and engineering majors at Australian and New Zealand universities. It is the first Australian edition of the book.

Profiles: Australian Women Scientists: This book was written to encourage girls to take up careers in science and engineering. It deals with the lives and scientific achievements of a group of high achieving women scientists. The book was published by the National Library of Australia. It was surprising to find out that it was used in women's studies programs in US universities and Colleges.

Mount Stromlo Observatory: From Bush Observatory to the Nobel Prize is published by CSIRO, Australia's premier scientific institution and will be launched at the Australian National University in December 2013. Written with Professor Harvey Butcher (Director of the Research School for Astronomy and Astrophysics up to January 2013) and Dr Ralph Sutherland (theoretical astrophysicist at the Research School) it deals with the major research programs, new areas of astrophysical research and future directions for research in astrophysics. Mount Stromlo Observatory is one of the top ten astronomical institutions in the world. I was invited to be a Visiting Fellow at the Research School for Astronomy and Astrophysics at the Australian National University to write the book.

Writing awards: I won two prestigious writing awards for my books, viz: the Nancy Keesing Fellowship awarded by the State Library of NSW and the C J Dennis Award for excellence in natural history writing. These awards are usually won by writers in the humanities. As recognition of my services to science and research I was awarded the NSW Royal Society Medal. The NSW Royal Society is the first scientific society in Australia and was founded in 1821. The first president of the Society was Governor Sir Thomas Brisbane.

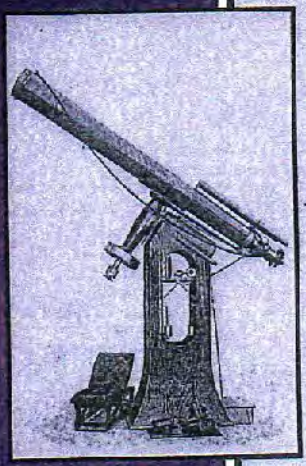
ABORIGINAL ASTRONOMY

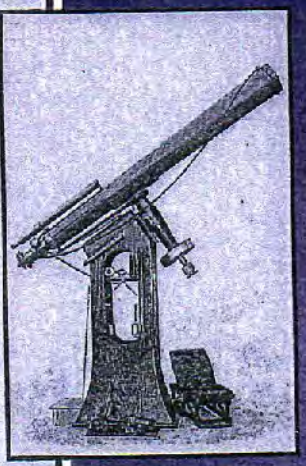
RAGBIR BHATHAL

SELECTED DOCUMENTS IN ABORIGINAL ASTRONOMY

RAGBIR BHATHAL

UNDER THE SOUTHERN CROSS





A BRIEF HISTORY OF ASTRONOMY IN AUSTRALIA

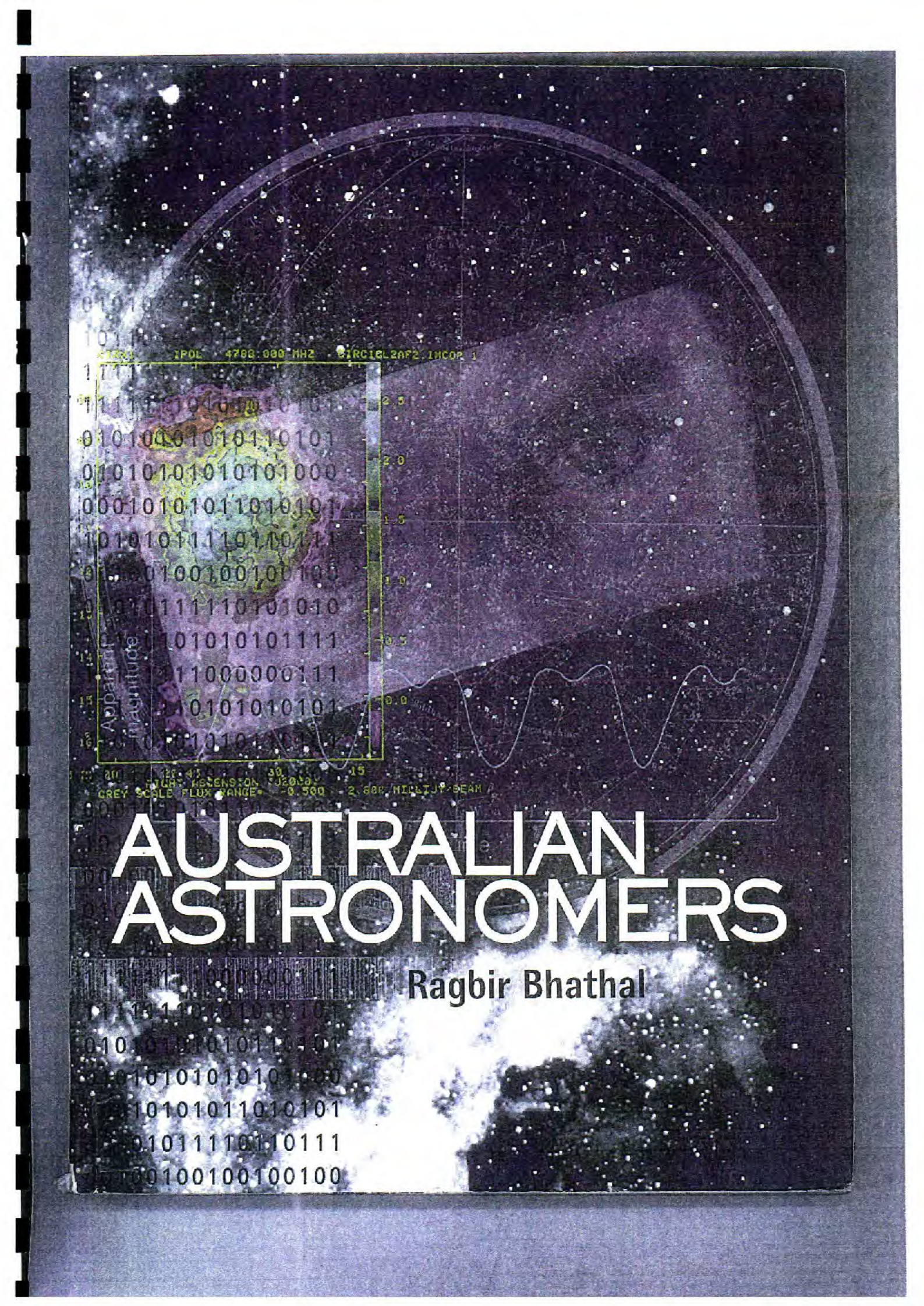
RAGBIR BHATHAL

AND GRAEME WHITE

AUSTRALIAN ASTRONOMER
JOHN TEBBUTT

The Life and World of the Man on the $100 note

RAGBIR BHATHAL

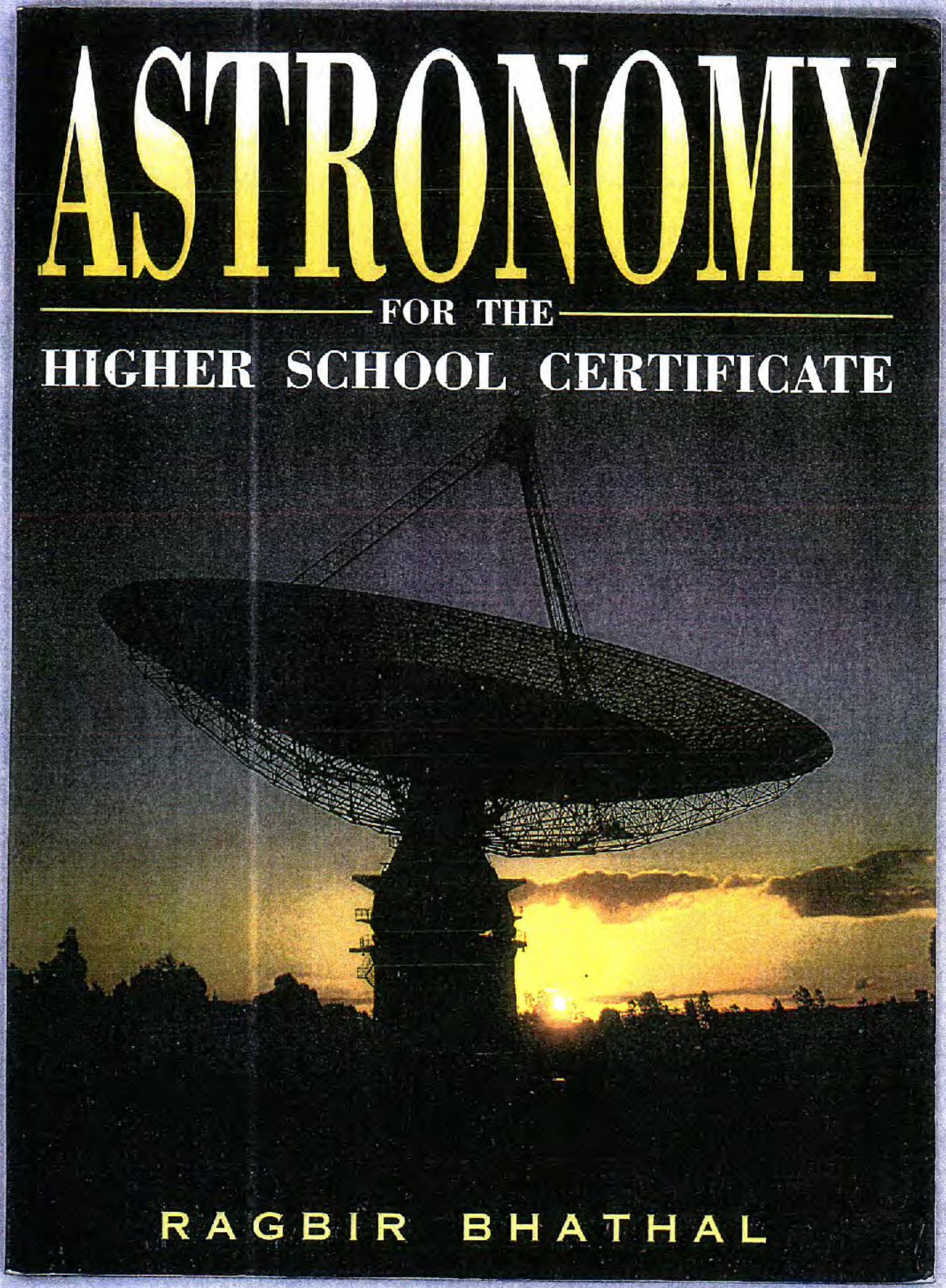


AUSTRALIAN ASTRONOMERS

Ragbir Bhathal

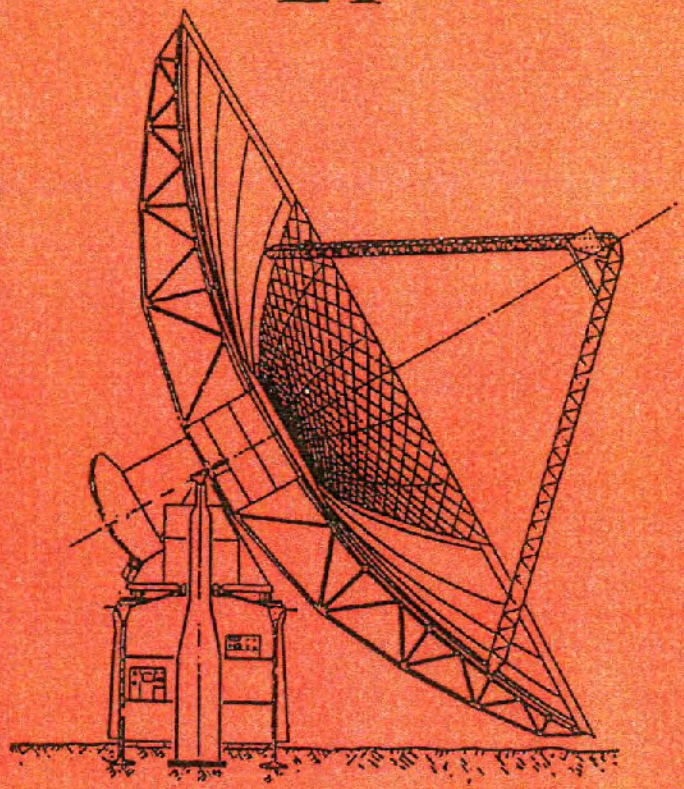
ASTRONOMY

FOR THE HIGHER SCHOOL CERTIFICATE

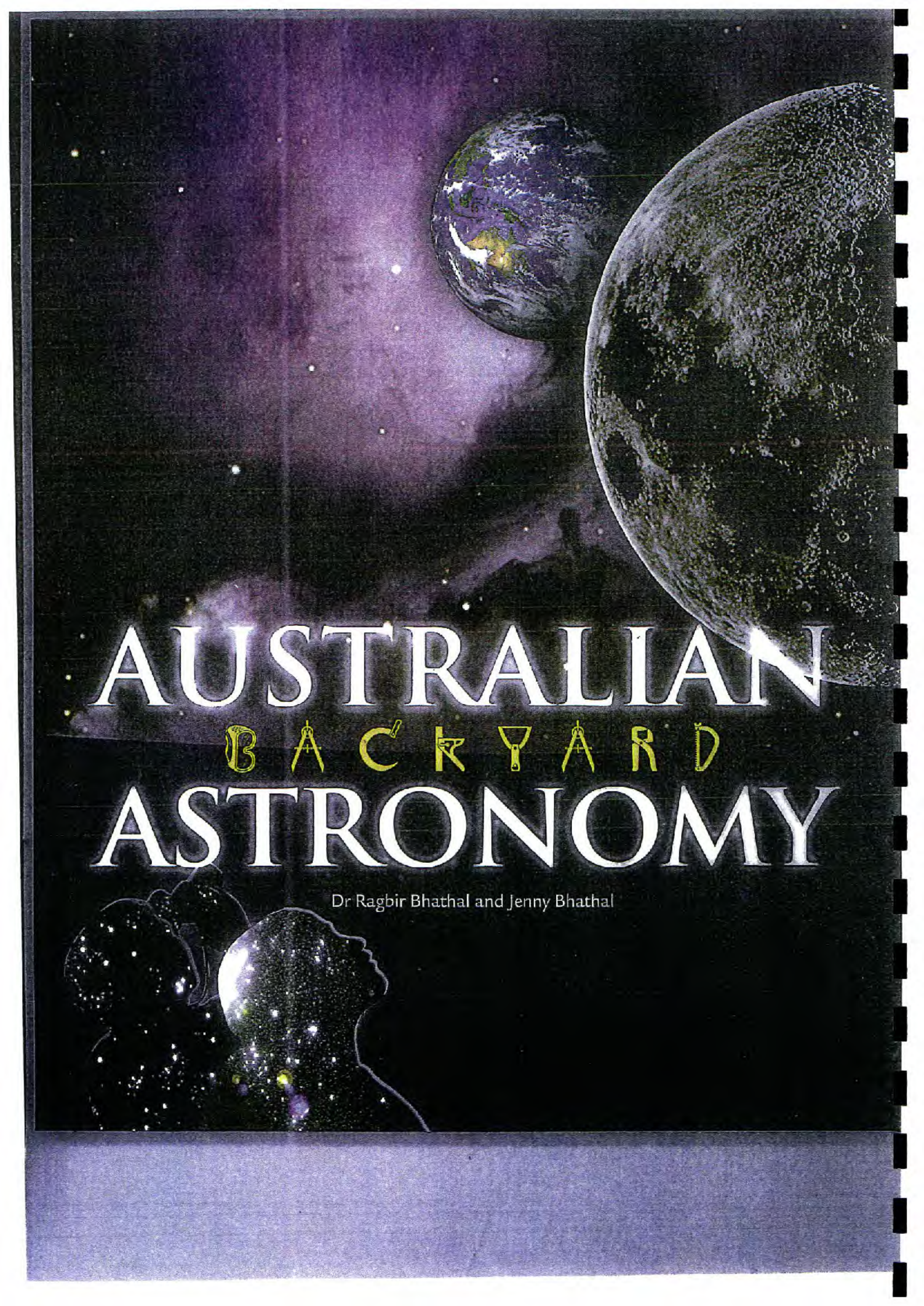


RAGBIR BHATHAL

SEARCHING FOR ET



RAGBIR BHATHAL


AUSTRALIAN
BACKYARD
ASTRONOMY
Dr Ragbir Bhathal and Jenny Bhathal

'There must be someone else out there'

By **Isabell Petrinic**

UWS physics and astronomy lecturer Ragbir Bhathal has spent 10 years searching for signs of intelligent life in the universe.

"There are 100 million million stars in our galaxy, so there must be someone else out there," Dr Bhathal told the *Star* on Friday.

"If there are extraterrestrials in the universe, the assumption is that they would more advanced than us, being one billion years older than us.

"Radio technology would be old-hat to them, which is why I use an optical telescope to look for ETs."

In fact, Dr Bhathal conducts the only laser search for ETs in the southern hemisphere.

"My instrument is built for looking for laser pulses, or light flashes," he explained.

He is not the only person wondering if we are alone in the universe, if the growing popularity of his astronomy nights is anything to go by.

Dr Bhathal is the director of the UWS observatory, which attracts hundreds of children, parents, grandparents and teachers to its sessions.

The presentations typically include a talk/slide show, question time and an opportunity to view the night sky through the telescopes.

The observatory, at UWS's Werrington North campus, houses the largest campus telescope in Australia.

"People are very interested in what is in the night sky," Dr Bhathal said.

> **'If there are ETs, I don't think they would send spaceships.'**
> **Astrophysicist Dr Ragbir Bhathal**

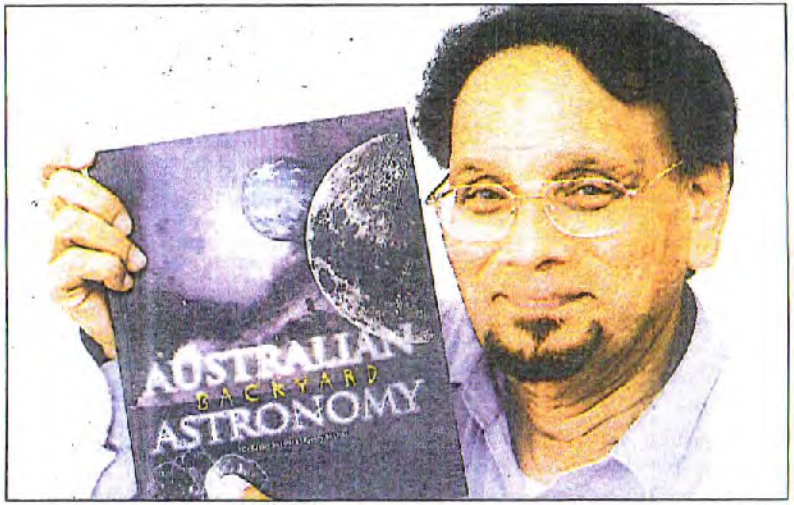
"They're always looking for ETs, wondering if they will send us a signal.

"We try to answer some of the big questions, such as how a star is born and what it is made of, and theories on how the universe started."

These and other questions are covered in his new book, *Australian Backyard Astronomy*, written over two years with help from his daughter Jenny Bhathal.

Dr Bhathal says it is important to develop and encourage children's interest in science as early as primary school.

The UWS Observatory is open to the public from Monday to Saturday. The next family session is on Friday, November 10, at 7pm. Details: Roslyn McCourt, 4736 0135 (Monday, Tuesday or Thursday, 9am to 1pm) or email r.mccourt@uws.edu.au.



Starry, starry nights: Dr Ragbir Bhathal's new book *Australian Backyard Astronomy* includes pictures of of the stars. It also presents children's activities and Aboriginal interpretations of the skies. **Picture: Gary Warnick**

OTHER BIG QUESTIONS . . .

Stone the crows!

What are the chances this crow would be flying over St Dominic's College, Kingswood, with a golf ball in its beak and that *Star* photographer, Gary Warnick, would have a telezoom lens on him and the hand-eye co-ordination to snap this pic? "Are you sure the photo isn't a fake?" UWS astrophysicist Dr Ragbir Bhathal said with a laugh. Another local probability expert, who did not wish to be named, said mathematical probabilities are calculated by doing experiments over and over again. "You're not going to hit golf balls until crows catch them," he said. "This event is extremely unusual, certainly improbable but it definitely happened."

Passion is sky high

ESTABLISHED in November 1991, the Western Sydney Amateur Astronomy Group Inc (WSAAG) meets at the University of Western Sydney, Werrington North Campus, in the Nepean Astronomy Centre on the third Wednesday of each month at 7.30pm.

Members come from all walks of life and have a diverse range of interests.

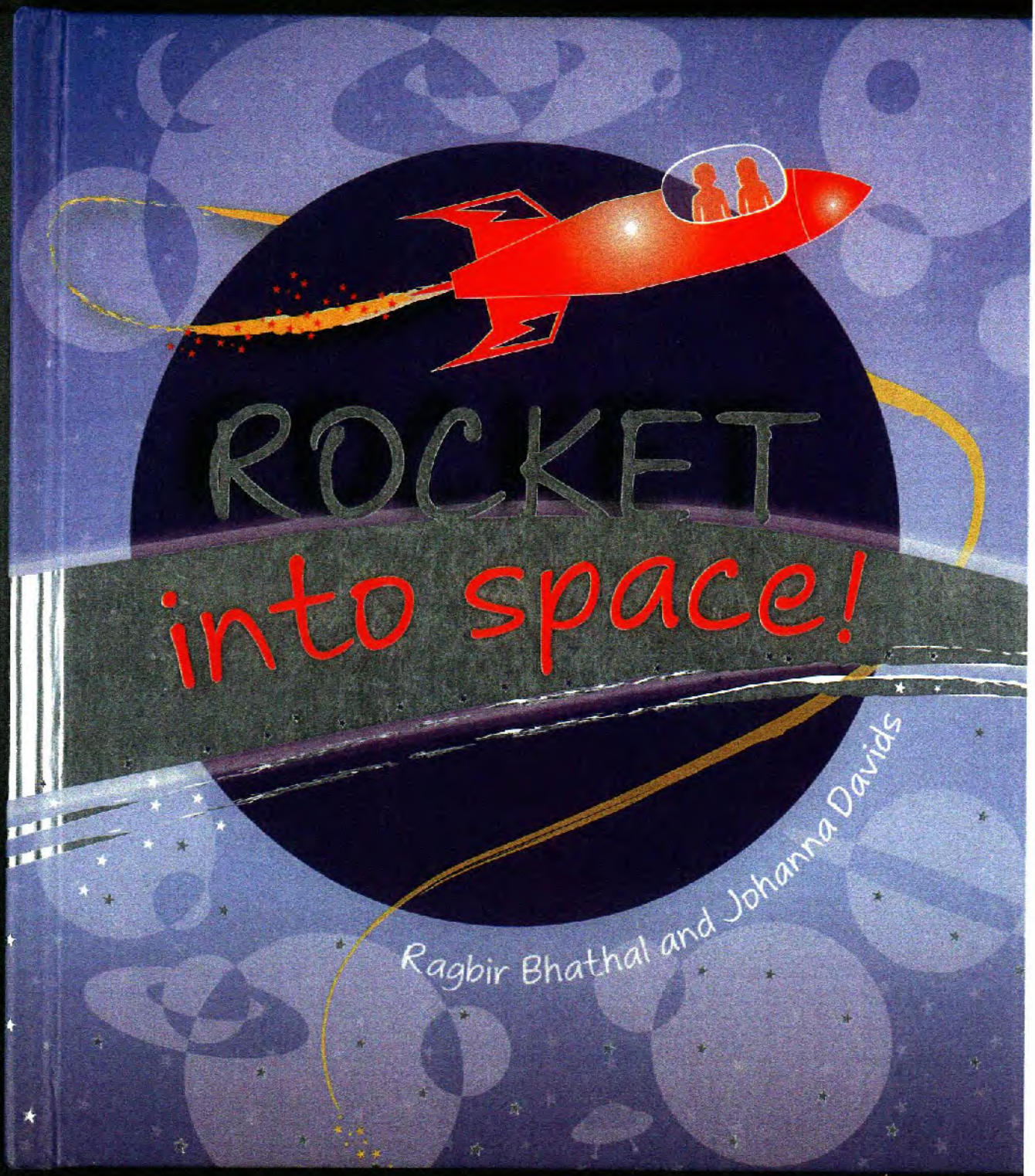
Some have telescopes, some don't.

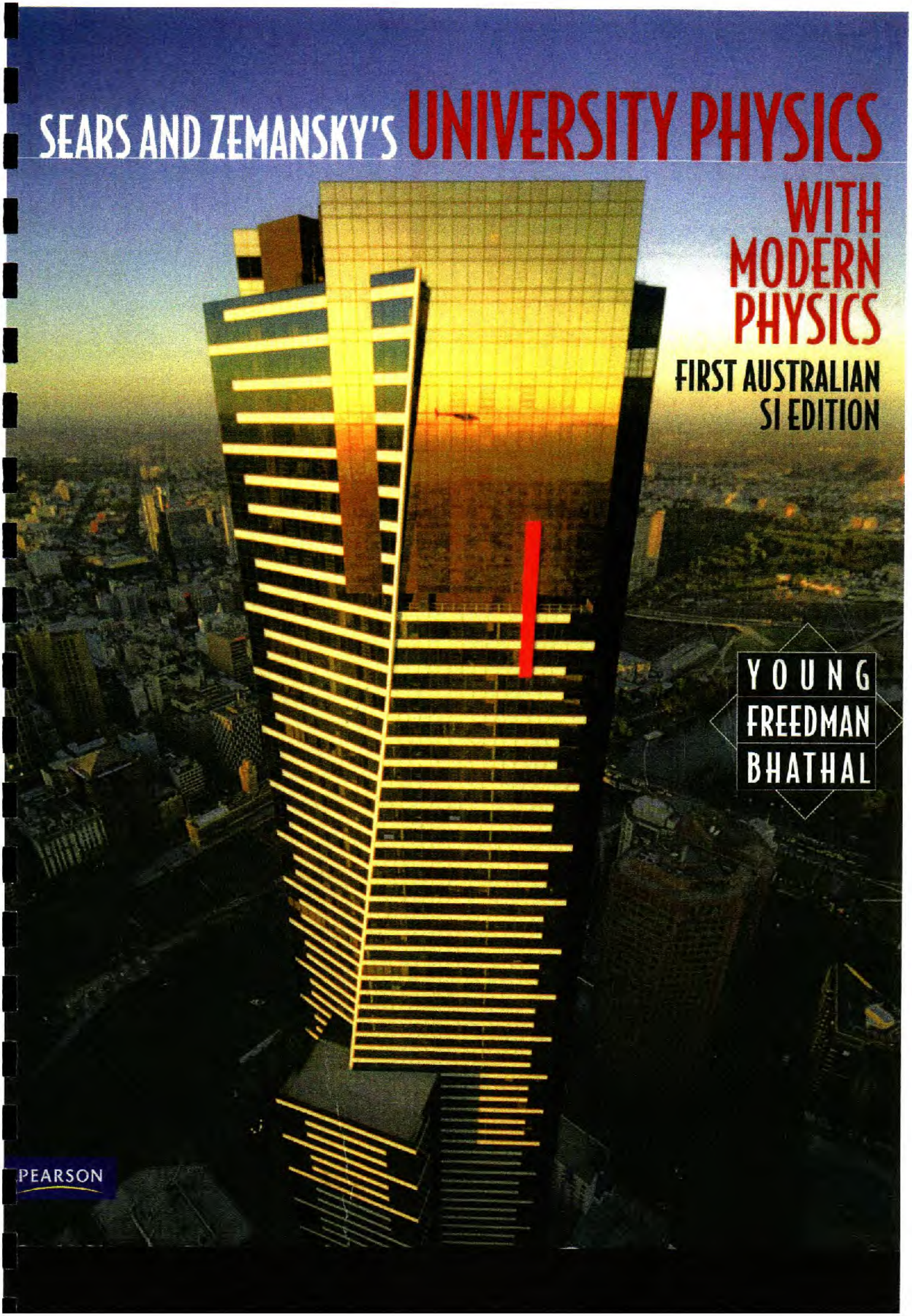
"All you need to join is anything from an interest to a passion for astronomy," said a spokesman.

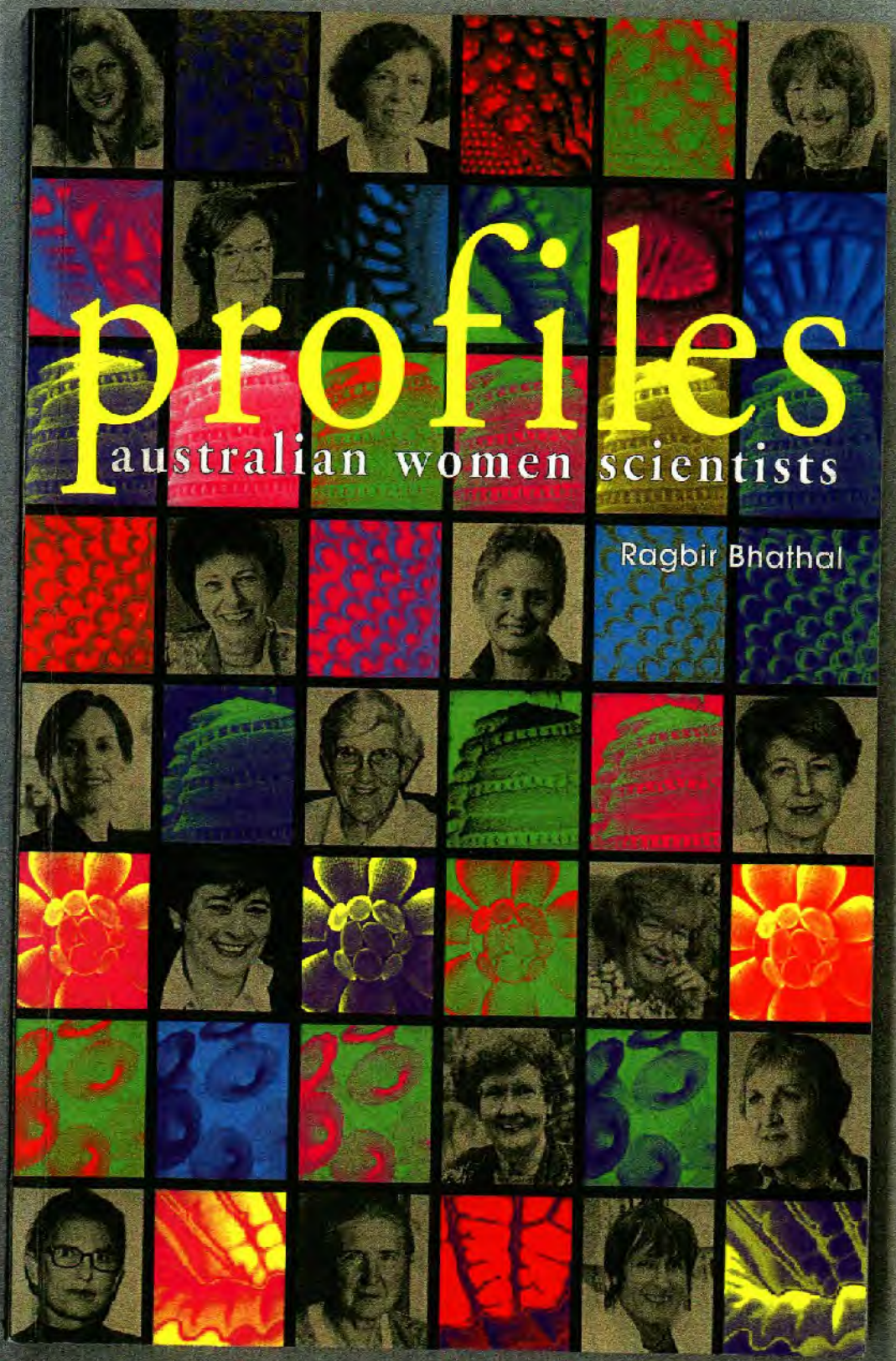
Dr Geoff Anderson will be the guest speaker at the next meeting on Friday, November 17.

He will talk about telescopes – their history, operation, discoveries, development and future. Twice a month there is also dark sky observing at the Linden Observatory in the Blue Mountains.

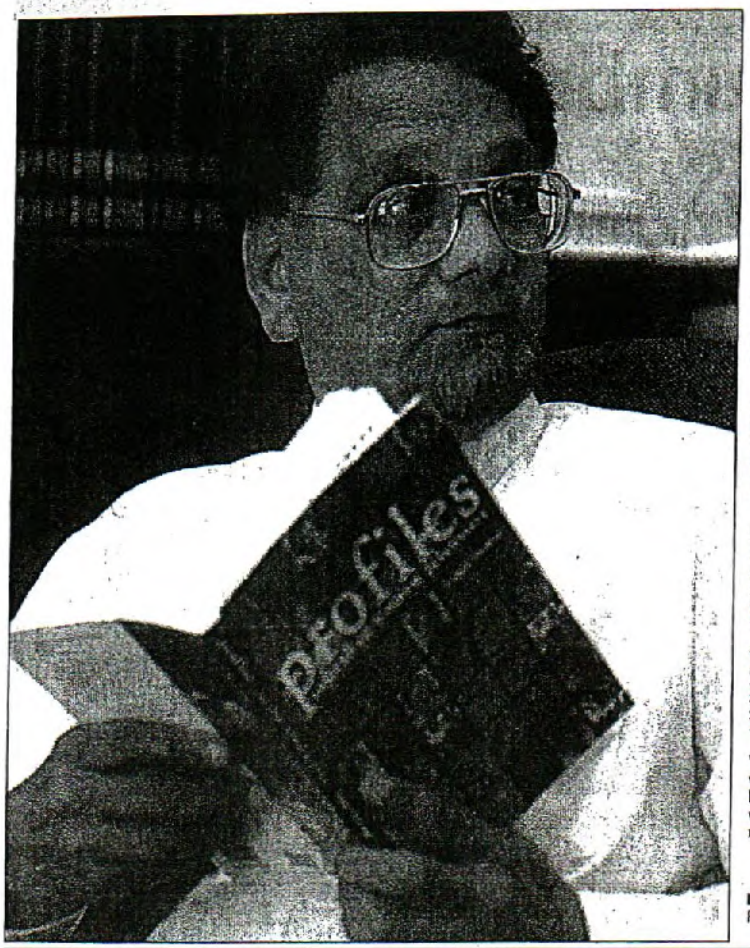
Details: users.tpg.com.au/users/wsaag/


ROCKET
into space!
Ragbir Bhathal and Johanna Davids


SEARS AND ZEMANSKY'S UNIVERSITY PHYSICS
WITH MODERN PHYSICS
FIRST AUSTRALIAN SI EDITION
YOUNG
FREEDMAN
BHATHAL
PEARSON


profiles
australian women scientists
Ragbir Bhathal

The Macarthur Advertiser, Wednesday, March 15, 2000



Salute to scientists

Women honoured

By BELINDA WEBER

THE lives and scientific achievements of Australia's top women scientists have been immortalised by a local university lecturer.

Dr Ragbir Bhathal, of the University of Western Sydney Macarthur, has just had his 15th book published by the National Library of Australia.

It will be added to the "Dr Ragbir Bhathal Collection" the library has set up on the National Bibliographic Index.

Profiles: Australian Women Scientists deals with 18 of the country's best female scientists who have won international recognition for their work in physics, biology, chemistry, mathematics, medical science and environmental science.

The book explores the lives of women such as Professor Suzanne Cory and Professor Jan Anderson.

Dr Bhathal said the rise of women in the Australian field of science was not easy and the numbers were still low compared to men.

He said that although the number of women in the biological sciences had increased tremendously, the rate of increase in the physical sciences had not been very great.

"For much of the 19th and 20th centuries, women have been kept out of science by male scientists and administrators," he said.

"In fact, medical scientists in the 19th century even tried to show that women's brains were smaller that those of men.

"However, attitudes towards woman in science have changed since the passing of the anti-discrimination laws in the 1970s.

"But it is still surprising to see that there is only 10 professional women astronomers among the 200 strong Australian astronomical community."

Dr Bhathal's latest project is a Year 2001 Federation project on Australian physicists, also supported by the National Library of Australia.

■ UWS Macarthur astrophysicist Dr Ragbir Bhathal reads his latest work, Profiles: Australian Women Scientists.

The University of Sydney NEWS

The greenhouse and the economy
Page 3

Sex and death
Page 4

Symphonic sea of sound
Page 7

Volume 31 No. 21 ISSN 0726-8637 26 August 1999

Prejudice and the pretty woman: 100 years of affirmative action

BY ANNE SARZIN

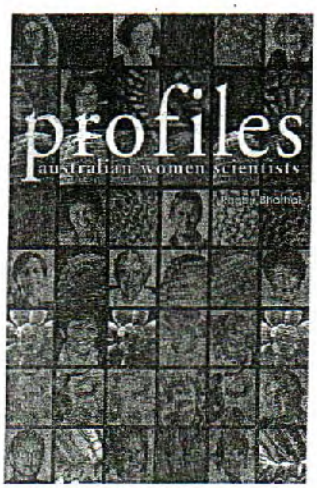
In an age of anti-discrimination legislation and affirmative action, it is easy to forget the battles educated women have fought to secure and retain their professional appointments.

A book that profiles prominent Australian women scientists also reveals the obstacles many of them faced in their careers.

Dr Ragbir Bhathal's *Profiles: Australian women scientists*, which includes a chapter on Sydney University respiratory diseases specialist Professor Ann Woolcock, contains many references to the University, not all of them flattering.

While the University played a seminal role in the education and careers of several women scientists in the book's elite cohort, many of them recall their male peers' bias against women scientists.

Of course it wasn't as blatant in the 1930s as it had been in the latter half of the 19th century. When Marion Charlotte (Horton) White, Sydney University's third woman science graduate, applied for a job as a junior demonstrator in biology in 1897, the Senate rejected her application on the grounds that "she was a woman and too pretty". In 1904 the Department of Anatomy appointed two women as honorary demonstrators, but it was not until 1908 that a woman was employed on the academic staff and then only as a junior demonstrator.



Dr Ragbir Bhathal's *Profiles: Australian women scientists*, which includes a chapter on Sydney University respiratory diseases specialist, Professor Ann Woolcock.

Cambridge-educated physicist Rachel Makinson, who later had a distinguished career in wool research at the CSIRO Division of Textile Physics, came to the University in 1939 but only on a casual basis. "The prejudice in Australia against married women working was colossal," she said. "But apart from that, I wasn't allowed to have a decent position in the University because my husband was already there. They had fathers and sons in the same department but not husbands and wives. It was an unwritten but definite policy."

But gradually, as Dr Bhathal describes it, "the cobwebs of prejudice began to be pulled aside". Professor Woolcock was among the wave of women entering the workforce after World War II, many of whom were helped by male mentors.

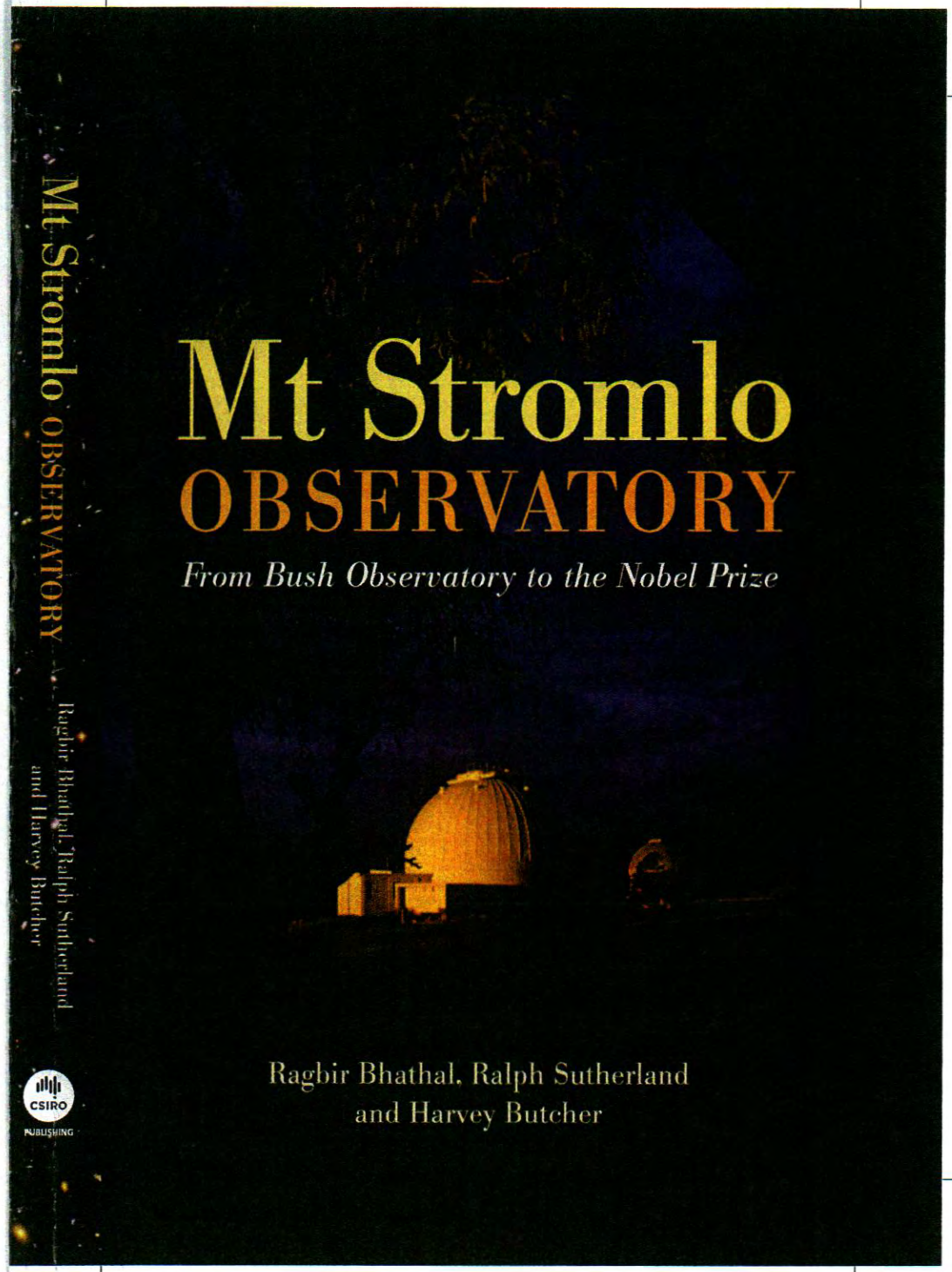
The chapter on Professor Woolcock offers insight into her work on respiratory disease in general and asthma in particular, which she has researched all her life. Interestingly, she believes that women scientists work more co-operatively than their male colleagues.

"My teams are nearly all women," she said. "They can do more than one thing at once. They are used to juggling their lives and their families and all these other things, so doing some more research is not hard for them.

"They have less egos, so that if something goes wrong, they're not so upset. It's a fact, it's not a criticism, it's how things are. I think female teams are very good."

Professor Woolcock concedes, however, that the lot of women researchers can be complex and challenging: childcare is more expensive, there are diminishing funds for research, and jobs can be poorly paid.

"But, given that, I think women will continue to be around and doing things and I hope that some of us are role models for other women," Professor Woolcock said.



ENGINEERING AND ASTRONOMY FOR INDIGENEOUS STUDENTS

I have been involved with improving the scientific literacy of Indigenous students from around the western suburbs of Sydney and country towns. The program is carried out in conjunction with the University's Community Engagement Office. I conduct experiments in engineering physics and talk to the students about modern and Aboriginal astronomy. They view the night sky through telescopes and try to appreciate how their ancestors would have viewed the night sky.

I ran a very successful one semester after schools program for Year 8/9 students from Windsor High School. The program was run with a grant of $15,000. It was very successful in changing the perceptions of students towards science and engineering and their applications. The project was written up and published in the refereed international Journal, Astronomy & Astrophysics. The program was shown on SBS World News. Arising from this program I was invited by UNESCO to present a paper at UNESCO's Paris headquarters at a conference to commemorate the International Year of Astronomy.

MEDIA MONITORS
INCISIVE INSIGHT

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12/09/2007
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Fortnightly

Stargazing at UWS - Indigenous students explore the universe

Only 29 per cent of Indigenous students complete Year 12 compared to 65 per cent for the broader Australian community, according to 2005 ABS figures.

Even more disconcerting, of the over 9000 university science graduates in 2005, only 25 were Indigenous.

The figures are worse in the case of science and engineering according to Dr Ragbir Bhathal from the School of Engineering at the University of Western Sydney.

In order to address this problem Dr Bhathal and his colleagues will be running a special astronomy project for Indigenous students at UWS.

"The aim of the project is to improve the scientific literacy of Indigenous students through out-of-school astronomy activities," Dr Bhathal says.

"Scientific literacy does not just imply scientific knowledge but also attitudes and procedures of multidisciplinary thinking.

"It also implies the ability of using the scientific way of thinking in daily life thus adding both social and scientific cultural capital to one's life and the community."

A group of Indigenous students from Windsor High School will be attending hands-on astronomy classes at the University's Observatory at the Penrtih Campus and will be viewing the night sky through the Observatory's computerised telescopes.

"The students will not only be learning about the latest advances in astronomy but will also be learning about 40,000 years of Aboriginal astronomy - an astronomical tradition they can be proud of," Dr Bhathal says.

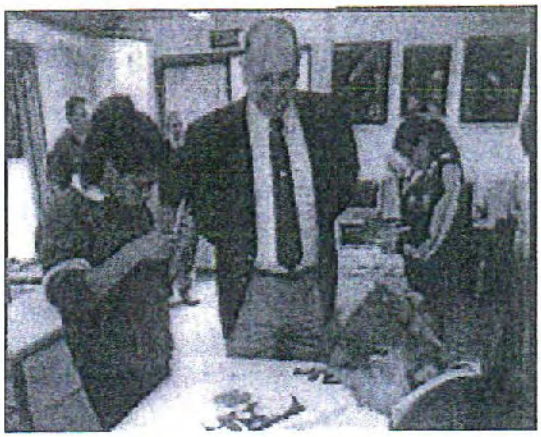
Some of the activities will involve making a simple telescope of the type that the great physicist and astronomer Galileo used to usher in the scientific revolution in the 16th century and, experimenting with impact craters and seeing how galaxies are rushing away from us in an expanding universe.

Dr Bhathal says by participating in this program it is hoped that the students will be encouraged to consider careers in science and engineering and blaze the trail for other Indigenous students to follow their example.

The program will run until December 2007 and include four sessions, one with parent involvement.

The program will be extended to other Indigenous students over the next few years.

The project is sponsored by the University of Western Sydney, under its University Engagement Program with the community it serves. It also has the support of the NSW Department of Education (Western Sydney region).



• **ABOVE: Students are encouraged and supported throughout the workshops.**

Western Press 24 Aug 07 p4

Students shoot for the moon

INDIGENOUS students can now explore the universe, thanks to the University of Western Sydney.

Australia Bureau of Statistics figures from 2005 reveal only 29 per cent of indigenous students completed year 12 compared to 65 per cent for the broader Australian community.

And of the more than 9000 university science graduates in 2005, only 25 were indigenous.

UWS School of Engineering's Dr Ragbir Bhathal said the figures were worse for science and engineering.

However, he and his colleagues hope to address the problem by running a special astronomy project for indigenous students at UWS.

The aim was to improve the scientific literacy of indigenous students through out-of-school astronomy activities, Dr Bhathal said.

"Scientific literacy does not just imply scientific knowledge but also attitudes and procedures of multi-disciplinary thinking," he said. "It also implies the ability of using the scientific way of thinking in daily life, thus adding both social and scientific cultural capital to one's life and the community."

A group of Windsor High School indigenous students will attend hands-on astronomy classes at the university's observatory at the Werrington North campus.

"The students will not only be learning about the latest advances in astronomy but also about 40,000 years of Aboriginal astronomy – an astronomical tradition they can be proud of," Dr Bhathal said. Activities will include making a simple telescope of the type physicist and astronomer Galileo used to usher in the scientific revolution in the 16th century and seeing how galaxies are rushing away from us in an expanding universe.

By taking part, it was hoped students would be encouraged to consider careers in science and engineering.

The program will run from August to December and include four sessions, one with parent involvement.

Indigenous Students

MEDIA MONITORS
INCISIVE INSIGHT

Education Today (Aust)
25/10/2007
Page: 15
General News
Region: National
Type: Magazines Lifestyle
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Quarterly

New indigenous astronomy project lights up the night sky

Following in the footsteps of Galileo

Leading academics are rethinking their approach to the basic educational opportunities offered to indigenous students following the release of some alarming new statistics.

Current research shows that only 29 per cent of Indigenous students complete Year 12 compared to 65 per cent for the broader Australian community, according to 2005 ABS figures. But even more disconcerting are the new figures, which show that, of the over 9000 university science graduates in 2005, only 25 were indigenous.

And the figures are worse in the case of science and engineering, according to Dr Ragbir Bhathal from the School of Engineering at the University of Western Sydney (UWS). In order to address this problem Dr Bhathal and his colleagues are running a series of special astronomy projects for Indigenous students at UWS.

'The aim of the project is to improve the scientific literacy of Indigenous students through out-of-school astronomy activities,' Dr Bhathal says. 'Scientific literacy does not just imply scientific knowledge but also attitudes and procedures of multidisciplinary thinking.

'It also implies the ability of using the scientific way of thinking in daily life, thus adding both social and scientific cultural capital to one's life and the community.'

A group of Indigenous students from Windsor High School in Sydney were among the first to attend the hands-on astronomy classes at the University's Observatory at the Werrington North campus. One of the highlights for the students was viewing the night sky through the observatory's computerised telescopes.

'The students are not only learning about the latest advances in astronomy but they are also learning about 40 000 years of Aboriginal astronomy – an astronomical tradition they can be proud of', Dr Bhathal says. 'Some of the activities involve making a simple telescope of the type that the great physicist and astronomer Galileo used to usher in the scientific revolution in the 16th century and experimenting with impact craters and seeing how galaxies are rushing away from us in an expanding universe.'

Dr Bhathal says by participating in this program, it is hoped that the students will be encouraged to consider careers in science and engineering and blaze the trail for other Indigenous students to follow.

The first classes began in August and the program will run until December 2007 and include four sessions, one with parent involvement.

The program will be extended to other indigenous students in the western suburbs of Sydney over the next few years. This event is sponsored by the University of Western Sydney, under its university engagement program with the community. It also has the support of the NSW Department of Education (Western Sydney region).

Contact: Dr Ragbir Bhathal tel (02) 4736 0834.

Research and International

ARC Research Scorecard

Minister Carr and the ARC have released the Research Scorecard and UWS School of Engineering achieved a 4/5 in Civil Engineering, FOR Code (0905) which ranks UWS equal 3rd in Civil Engineering in Australia and states " The Unit of Evaluation profile is characterised by evidence of performance above world standard presented by the suite of indicators used for evaluation."

Engineering FOR Code (09) received a 3/5 at UWS which placed the School 10th out of 30 Engineering Schools in the Country. A ranking of 3 states "The Unit of Evaluation profile is characterised by evidence of average performance at world standard presented by the suite of indicators used for evaluation".

Australian Government

Australian Research Council

New research Group

Reverse engineering the brain

A new Research Group for Bioelectronics and Neuroscience (BENS) has been funded by the College of Health and Science at UWS from strategic investment funds. Two new professors will join UWS as part of this effort: Prof André van Schaik, a world leader in neuromorphic engineering has been appointed as the group leader, and Prof Jonathan Tapson, an expert in statistical computation, sensors, and robotics, will join BENS in April, 2011. Expertise in sensory neuroscience is provided by four staff members from the School of Medicine, Prof Vaughan Macefield, Prof John Morley, Dr David Mahns, and Dr Carl Parsons. Dr Antonio Lauto, an expert in biomedical engineering, from the School of Biomedical and Health Sciences completes the current staff, with more staff expected shortly.

The question of how the brain works is one of the remaining big questions in science, and reverse engineering the brain has been listed as one of the most important contributions engineering can make to science in the current century. BENS will conduct neurophysiological and psychophysical investigations combined with theoretical, computational and electronic modelling studies, to discover how the brain creates a coherent interpretation of the external world based on input from its senses. The outcomes of this research will then be applied to create electronics sensors with built-in brains.

Staff Publications

Aboriginal Astronomy

As part of the School's strategic initiatives of implementing a comprehensive Indigenous strategy and improving cultural sensitivity, Dr Ragbir Bhathal has researched and written a book on Aboriginal Astronomy. His research shows that the Aboriginal people were not only keen observers of the night sky but were also able to distinguish the colours of the stars and even related the movement of the stars to the seasons and food supply cycles. They also beat the great physicist Isaac Newton to the recognition that the earthly laws of physics apply to the heavens. Their views of the night sky not only differ from, but probably pre-date, those of other civilisations. Professor Michael McDaniel, a former UWS Dean of Indigenous Education, congratulated Dr Bhathal for his work.

Moving Loads

Dr Xinqun Zhu in collaboration with Professor Siu-seong Law (Hong Kong Polytechnic University) has published a second book by Taylor & Francis Group, CRC Press on 22 February, 2011. Titled, Moving Loads--Dynamic Analysis and Identification Techniques, the book is a study of the vehicle-bridge/track/road interaction phenomenon.

Astronomy for Aboriginal students

Ragbir Bhathal describes a schools project that uses astronomy to encourage Aboriginal pupils to consider studying science.

ABSTRACT

Only 0.003% of the 9000 university science graduates in 2005 in Australia were of Aboriginal origin. This is a national disgrace in a country that prides itself on giving its inhabitants a "fair go". This paper discusses an astronomy project that seeks to improve the scientific literacy of Aboriginal students so as to motivate them to take up careers in science and engineering.

One of the major problems in 18th-century astronomy was to ascertain the distance between the Earth and the Sun in order to provide a scale for the universe. In 1716 Edmond Halley suggested that this distance could be measured by timing the transit of Venus across the face of the Sun. Captain James Cook was dispatched to Tahiti to make these measurements at the next possible opportunity – in June 1769.

After observing the transit, Cook headed west in search of a "southern continent". On 19 April 1770 he sighted Cape Everard near the southeast extremity of the Australian mainland. As his ship made its way north along the coast of New South Wales, the Aboriginal inhabitants lit fires to warn their people of strangers along their shores; on board the *Endeavour* the young naturalist Joseph Banks, on first sighting Australia, wrote in his diary, "large fires were lighted this morn at 10 o'clock" (Badger 1970).

For the next few months Cook explored and mapped the eastern coast of Australia. He carried out nautical astronomy to determine latitude and longitude, and before returning to England he claimed the land in the name of King George III. Thus a voyage of scientific discovery, organized by the learned scientific society the Royal Society of London for the purpose of determining the distance of the Earth to the Sun, first brought the British into contact with the eastern coast of Australia and its original inhabitants. Cook proclaimed the land "*Terra Nullis*" (Latin for a "land belonging to no-one", a concept in European international law in the age of European colonization), thus acting against his instructions to negotiate with any original inhabitants. This was the beginning of disadvantage for the original people of Australia – a disadvantage that has resonated throughout Australian social, educational and political culture right up to the 21st century. It remains an issue of importance to this day, so much so that the Prime Minister of Australia on 13 February 2008 apologized to the Aboriginal people for the mistreatment and misdeeds inflicted on them by previous Australian governments.

In 2005 the Australian Bureau of Statistics noted that only 29% of indigenous students completed Year 12 or the Higher School Certificate (the equivalent of sixth form in the UK), compared to 65% for the broader Australian community. Out of the 9000 university science graduates in 2005 only 25 were of indigenous origin. This is 0.003% of the science students graduating with science degrees. This national disgrace is a disaster for science education policy for Aboriginal people in Australia.

What is happening?

The University of Western Sydney is in an area with a large Aboriginal community and a high number of Aboriginal schoolchildren. The number of Aboriginal students studying science – and in particular physics – at the Higher School Certificate level is minimal. According to the teachers in the Western Suburbs of Sydney, 70% of Aboriginal students drop out of school before Year 10 (the equivalent of the end of Key Stage 4 in the UK). It is also remarkable that no Aboriginal student has passed through the first-year engineering course at the University of Western Sydney in the past 10 years, despite the fact that there is a large cohort of Aboriginal students in the schools around the University. The Aboriginal community feels that Aboriginal students should be encouraged to study science and engineering and to consider taking up careers in engineering and science.

With this in mind the author developed a series of astronomy activities in the hope of motivating Aboriginal students to take an interest in science. The project comprised five sessions taking place in the second semester (from August to December 2007) of the university term, with a group of 15 lower secondary Aboriginal school students (UK equivalent Key Stage 3). Students not only carried out the projects at the University observatory and the physics laboratory in the School of Engineering, but also had homework that they carried out in school as a follow-up.

The aims of the project were: to improve the scientific literacy of the students by involving them in a series of astronomy activities that not only used the knowledge of Aboriginal astronomy but also of modern scientific astronomy; and to heighten their curiosity about things scientific. They looked at the night sky with the naked eye and also through the University's computerized telescopes, to learn how scientists explore natural phenomena and how they test their ideas and models through experiments and observations. This approach also showed how two knowledge systems (modern scientific astronomy and Aboriginal astronomy) view the night sky.

Three key performance indicators were used to assess the success or otherwise of the project: knowledge gained by the students of modern scientific astronomy, of Aboriginal astronomy, and of the methods and processes of science.

Appropriate teaching methods

There is much debate in the educational literature about learning styles and culture (Claxton and Murrell 1987, Guild 1994). However, it is difficult to draw any generalizations from these studies because of the complexity and limitations of learning styles as a diagnostic tool. Most of the research in this area is based on studies of the experiences and needs of children from minority cultures in the US, with very little work relevant to the teaching of Aboriginal students – let alone in science and engineering. A hands-on approach was considered the appropriate method of teaching, just as it is for other students studying science and astronomy. The hands-on approach uses concrete experiences and manipulation of scientific apparatus in the laboratory. However, in addition to this we have, as suggested by Craven (1999), adopted the method of using a cross-cultural knowledge theme to build on the cultural knowledge base of the students. To this end two knowledge systems and perspectives were used: the view of astronomy from an Aboriginal perspective (Bhathal 2006) and the view from modern scientific astronomy (Freedman and Kaufmann 2007).

Astronomy is one of the oldest of the scientific

TEACHERS, PUPILS AND PARENTS POOL THEIR KNOWLEDGE AT THE UNIVERSITY OF WESTERN SYDNEY

disciplines and the night sky has always intrigued and continues to intrigue human beings. Thus astronomy provides an excellent vehicle not only to satisfy the natural curiosity of young people about the heavens, but also of a way of improving their scientific literacy. By improving their scientific literacy students will be able to explore the natural world on their own and also learn to enquire about the opportunities offered by universities and other educational institutions in terms of preparing themselves for careers in science and engineering.

The project also envisaged that the students would learn transferable skills including mathematical skills, scientific skills (developing ideas and testing of these ideas), measuring, using and manipulating scientific equipment, drawing inferences, observing the night sky with the naked eye and through telescopes, calculating, drawing graphs and using the graphs to draw conclusions from the data, using art to express ideas, communicating their ideas orally, appreciating two different astronomical knowledge systems, working in groups and learning to use the internet to get information for their projects.

The astronomy projects

The students undertook the following five projects: the solar system, properties of light and building a simple telescope, making some astronomical measurements, craters on the Moon, and the search for life in the universe.

For the project on the solar system, the students were provided with information on the various aspects of the solar system, for example its origin and properties. For their experimental work they constructed a solar system mobile based on the properties of the planets in the solar system. They weighed themselves and then calculated their weight on the other planets, confirming what they had learnt about the properties of different planets. Then they viewed the planets through telescopes, following which they discussed how the Aboriginal people view the planets and talked about the stories associated with the planets from an Aboriginal perspective. For example, Venus is known as Barnumbir or the Morning Star in Arnhem Land and is associated with death. A discussion of the Morning Star ceremony was also used to highlight the connection between the planets or celestial bodies and their role in the social culture of the Aboriginal people.

In the project on the properties of light, the students learnt how the scientific model that light travels in straight lines is tested in the laboratory and how scientists draw inferences from this model of the rectilinear propagation of light (Toulmin 1967). They performed a simple classic experiment (light travels in straight lines) to see how scientists validate their models, scientific theories and ideas with experimentation. They experimented with light beams travelling through various lenses and being reflected from various mirrors. The students were shown how the model that light travels in straight lines is used to explain the length of shadows and how it is also used for practical purposes in making a telescope. The students built a simple telescope with two lenses very much like the telescope that Galileo used in the 16th century to overthrow Aristotelian physics and usher in the scientific revolution (Freedman and Kaufmann 2007).

As part of observing the night sky with the naked eye and the telescopes, the students were shown how to locate the Southern Cross and how to use it to find their way at night. They were told that the Southern Cross was first observed by Andreas Corsali, a Florentine traveller who sailed with a Portuguese expedition to Goa in India in 1515. He described the constellation of stars as a cross (Bhathal and Bhathal 2006), seeing it from the perspective of his Christian heritage. But according to the well-known Aboriginal poet and writer Kath Walker (Aboriginal name Oodgeroo Noonuccal) (1972), long before the Europeans named this group of stars the Aboriginal people already called it Mirrabooka. In Arnhem Land the Southern Cross is seen as a shark chasing a stingray.

Parents were also invited to attend and participate in the astronomy night. This was an important exercise as the parents could see firsthand what their children were learning and provide the motivation to encourage their children to continue their education to the Higher School Certificate level. The students were then asked to envisage themselves as living about 10000 years ago. They were asked to draw the constellation and write and tell the story about the stars they had written about. Apart from the scientific skill of observing Nature, this exercise also developed in them artistic and communication skills.

Project three involved students in making scientific measurements and learning how to use the telescope and the planisphere to find the location of stars. As an exercise in the physics laboratory they found how to measure the distance to a star. They followed the same method that astronomers use in finding the distance to stars but with rather simple laboratory equipment. The aim of this project was to show the scientific process in action.

The fourth project dealt with craters on the Moon and how they were formed. A discussion on asteroids and their impact on life on Earth generated a lot of interest. The students did an

PHOTOGRAPHS BY J BOKTOR, F FARRUGIA AND L MAIONE

experiment in the lab with a sand tray to represent the surface of the Moon. They dropped various sized steel balls from different heights and measured the diameters of the resulting craters. They then drew graphs and extracted information and made inferences from them. This part of the project concluded by talking and discussing how the Moon was formed from a modern scientific point of view and how the Aboriginal people thought the Moon was formed and how they explained the phases of the Moon. We also discussed Aboriginal stories about the Moon in the context of their social culture.

The final project focused on the search for life in the universe, a NASA flagship programme. We used this project to inform the students what is happening at the forefront of astronomy research in the area of finding life elsewhere in the universe. They were asked to design a message to ET, taking into consideration some of the following questions: Should the message be mathematical? Should it be a drawing? Should it have chemical symbols? Should it be in binary numbers? After having completed their designs the students were asked to tell the class about their design and defend it.

Outcomes

One of the surprising outcomes of the project was that the students had very little prior knowledge of Aboriginal astronomy. This is partly due to the fact that successive Australian governments had attempted to "wash out" the Aboriginality and Aboriginal culture from earlier generations of Aboriginal people (Human Rights and Equal Opportunity Commission 1997). At the end of the project the students said that they knew more about Aboriginal astronomy now than when they first started the project. All of them not only found astronomy interesting but they loved looking at the heavens through the telescopes. This is similar to what is found in the general population who visit the University's observatory on astronomy nights for the public. They found the experiments they conducted at the University interesting and said that they would like similar experiments to be done at school. Most of the students found school science boring. At the start of the project only 7% of the students agreed with the statement "Science is about ideas and experiments to test whether they are right or wrong", whereas at the end of the project 93% agreed. It was also interesting to find out that more students (67%) were considering carrying on to do the Higher School Certificate after participating in the project than beforehand (20%).

The overall outcome of the project was positive in changing their attitudes to science and its processes. Students found out about both Aboriginal astronomy and modern scientific astronomy and were able to appreciate that there were two world views of the universe: a sociocultural and a scientific. A greater percentage of the students would like to continue their studies up to the Higher School Certificate level after participating in the project. Part of the project was shown on national TV news as an item of significance in Aboriginal science education in Australia. It is envisaged that the project will be offered to other Aboriginal students in the schools in the Greater Western Sydney region through the NSW Department of Education. ●

Ragbir Bhathal is an astrophysicist in the School of Engineering at the University of Western Sydney in Australia. He is undertaking a national project on Aboriginal astronomy.

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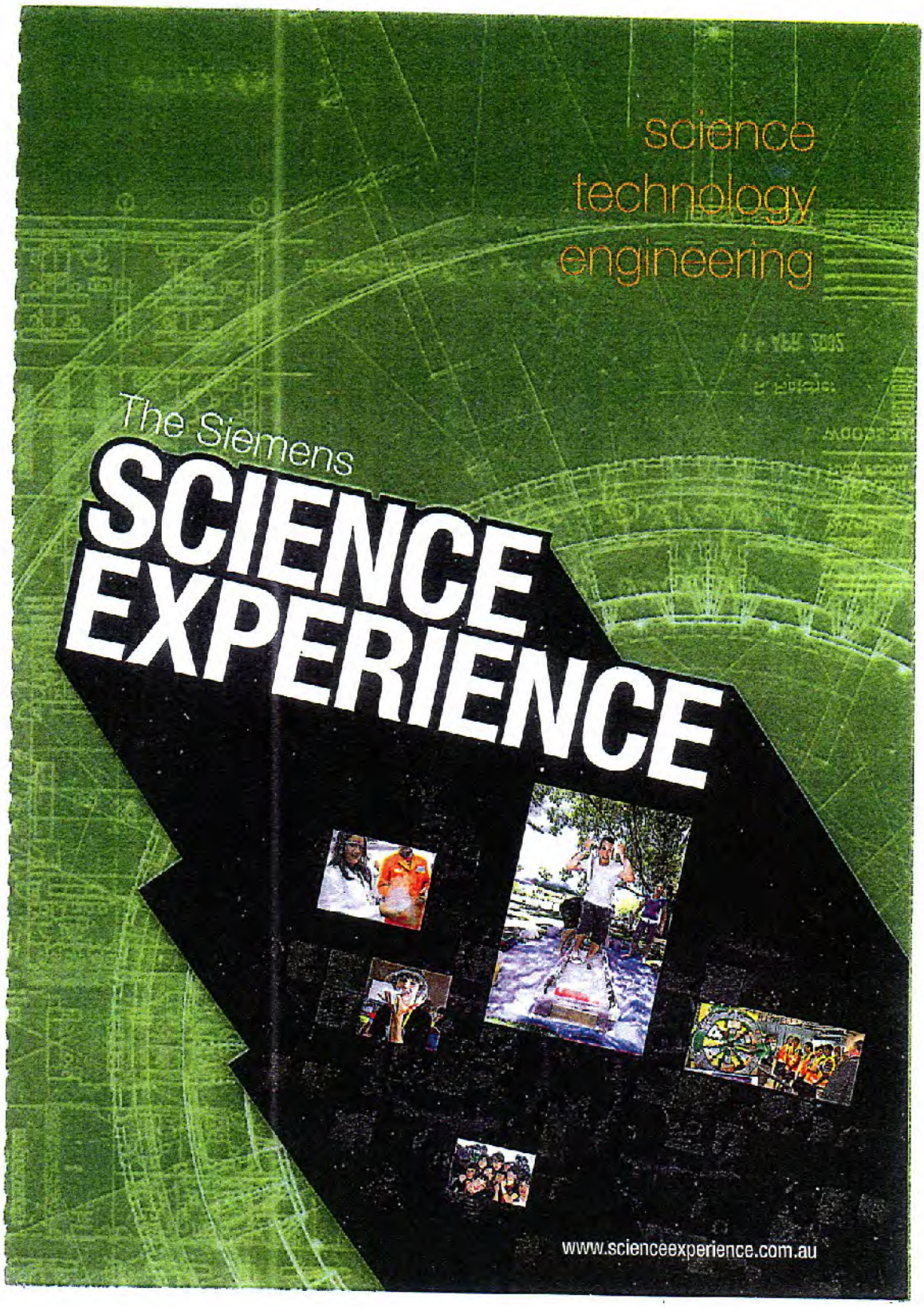
ENGINEERING, MEDICINE & SCIENCE EXPERIENCE

This is a 3 day program for Year 9/10 students from the western suburbs of Sydney and is sponsored by Siemens and the Science Foundation. It is run in December. I have run this program for over ten years. About 80 -100 top students from schools in the western suburbs of Sydney have participated in this program. In the morning students attend lectures given by the University's high profile and research active academics and in the afternoon they do experiments in the laboratories. About 30% of the students come and study at the University.

ENGINEERING FRONTIERS AND NASA SPACE CAMP

I am organising a new program to attract high achieving HSC students to come to UWS to study engineering. The two day program will be held in December 2013. It is partly sponsored by Engineers Australia.

With the Science Teachers Association (Western Sydney Branch) I am involved with conducting a program at the UWS Campbelltown Campus to prepare students for their two week Space Camp at the NASA Space Centre in the USA. This program caters for about 50 top students and teachers from the Western suburbs of Sydney.


science
technology
engineering
The Siemens
SCIENCE
EXPERIENCE
www.scienceexperience.com.au

Year 9 students go to university

YEAR 9 students are invited to live the life of a university student for a few days at the University of Western Sydney, Campbelltown.

UWS is hosting the Siemens Science Experience, from December 10 to 12, for students who have an interest in science and engineering.

The young scientists and engineers will be treated as if they were university students.

The university's top scientists and engineers will conduct a series of talks, lecture-demonstrations, hands-on lab sessions and field trips.

A number of the talks will cover new and emerging fields of science and engineering, such as nanotechnology, space communications, genetic engineering, photonics, robotics, and astrobiology.

Although primarily for year 9 students, year 8 students who excel will be accepted on the recommendation of their science teachers.

There are 30 places reserved for local students.

Application forms and further information can be obtained from science teachers in schools or directly from Dr Ragbir Bhathal on 4736 0834.

Applications close on November 10.

SCIENCE EXPERIENCE

MEDIA MONITORS
INCISIVE INSIGHT

District Reporter Camden
12/10/2007
Page: 10
General News
Region: Camden
Type: Suburban
Size: 97.14 sq.cms
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Opening the doors on science

The University of Western Sydney is holding its annual Science Experience at the Campbelltown Campus, December 11-13. The three-day Science Experience is open to all year nine students.

The program has interesting talks by experts, demonstrations, hands-on sessions and field trips in the areas of engineering, medicine and science.

Dr Bhathal, Chairman of the Organising Committee, says the aim of the Siemen's Science Experience is to encourage more young local boys and girls to take up careers in engineering, medicine and science.

"The Science Experience is a tremendous opportunity for students to come and get a taste of what university life is like for three days," Dr Bhathal says.

"They will also be able to listen, meet and swap ideas with some of the university's nationally and internationally recognised academics who are experts in engineering, medicine and science.

Parents of year nine students should encourage their children to attend this exciting and innovative program which will broaden their children's perspective on the kinds of jobs that are available in these areas," Dr Bhathal says.

Students who have attended the previous year's Science Experiences have not only enjoyed the activities but have also found them extremely rewarding, Dr Bhathal says.

"Many of those are now studying at the University of Western Sydney and at other universities."

Year nine students who wish to attend can obtain application forms from their head science teacher at school, the Rotary Club in their local area or from Ros McCourt at the University of Western Sydney by calling (02) 4736 0135.

University of Western Sydney

Bringing knowledge to life

ENGINEERING FRONTIERS 2013

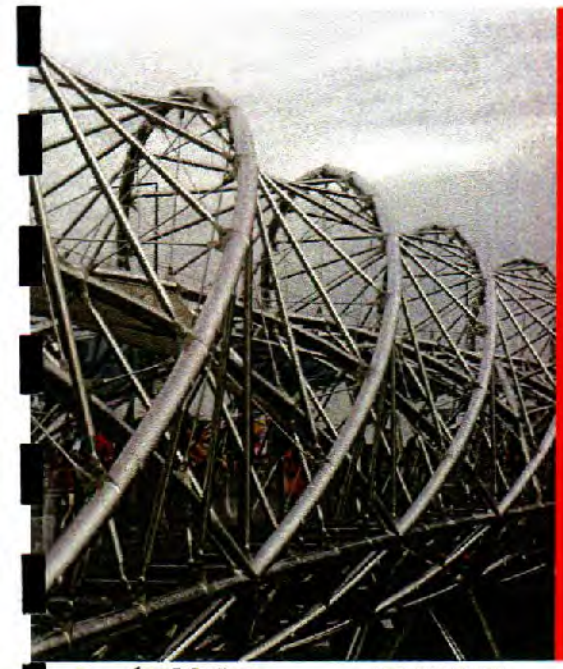
Two days of engineering activities for students in Year 10

Monday 9 December and Tuesday 10 December 2013

ORGANISED BY
SCHOOL OF COMPUTING, ENGINEERING AND MATHEMATICS
UNIVERSITY OF WESTERN SYDNEY

proudly sponsored by

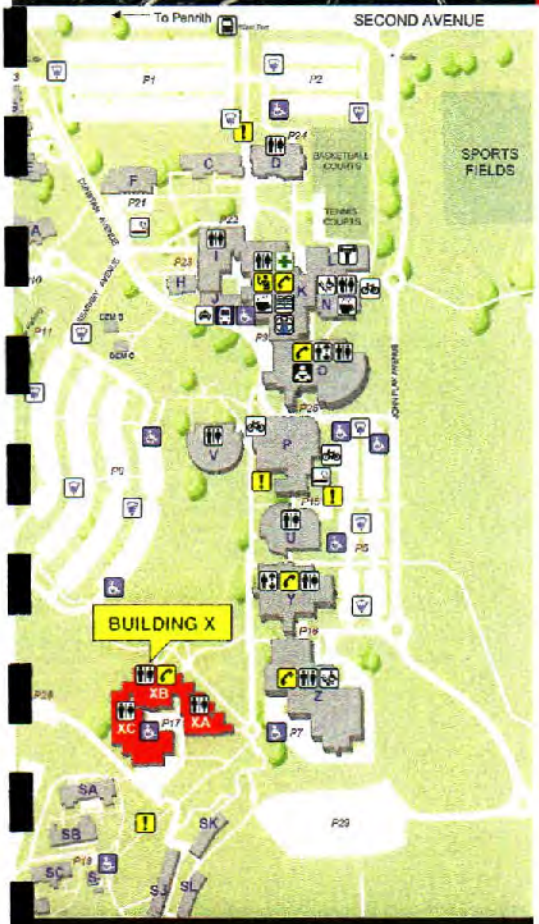
ENGINEERS AUSTRALIA



OBJECTIVES OF ENGINEERING FRONTIERS

COME AND FIND OUT

WHAT IT IS LIKE TO STUDY ENGINEERING AT A UNIVERSITY
WHAT THE LATEST ADVANCES IN ENGINEERING ARE
WHAT THE EXCITING CAREERS IN ENGINEERING ARE



Dear Parent/Guardian and Student,

Your child is one of the few who has been selected by your school to participate in the University of Western Sydney's Engineering Frontiers program. This two day program will introduce Year 10 students to Engineering and its applications. We believe that students will find Engineering Frontiers exciting, educational and useful for making their career choice.

It is a great opportunity for high school students to find out what it is like to study engineering at university. Students will be exposed to top engineers who have a passion for what they do. The days will be filled with lectures on the latest advances and developments in engineering, demonstrations and hands on workshops in our laboratories. Topics in various areas of engineering (civil, mechanical, electrical/electronics, robotics/mechatronics, water and environmental) will be covered, giving students an understanding of the depth and scope of the engineering field of study and the potential career opportunities.

Engineering Frontiers will be held

9am to 3pm
Monday 9 December 2013 and Tuesday 10 December 2013

University of Western Sydney, Kingswood campus
Buidlings XA and XB Second Ave, Kingswood

Registration will be at 8.45am, Monday 9 December,
Building XA Ground Floor Room 03 (there will be signage)

Morning tea and lunch will be provided each day.

All application forms need to be returned to the School of Computing, Engineering and Mathematics before 15 November 2013.Places are limited and students will be given a place on a first come first serve basis. You will receive a registration pack when your application has been successful.

Getting Here
Parents and/or Schools are to arrange students' transport to and from the program each day. Please be aware that as this is not during our semester time our shuttle buses will not be running. For assistance visit:
http://www.uws.edu.au/campuses_structure/cas/campuses/getting_to_uni

Parking
P29 is the closest parking area. Please note free parking permits will be supplied with your registration.

Dress
All students must wear closed in shoes or boots (no ballet flats or Crocs), long hair must be tied back, no hanging clothing or jewellery is allowed. Any student not adhering to these requirements will not be permitted into any UWS laboratory.

Contact Details

If you have any questions about completing the application form, please contact:
Rebecca Birnie, Senior Administrative Officer
School of Computing, Engineering and Mathematics,
University of Western Sydney,
Penrith campus (Kingswood)
Locked Bag 1797, Penrith NSW 2751
Phone 02 4736 0189 Fax: 02 4736 0833
Email: r.birnie@uws.edu.au

If you have any questions about the Engineering Frontiers course, contact:
Dr Ragbir Bhathal, Chairman, Engineering Frontiers
School of Computing, Engineering and Mathematics
University of Western Sydney,
Penrith campus (Kingswood)
Locked Bag 1797, Penrith NSW 2751
Phone 02 4736 0834 Email: r.bhathal@uws.edu.au

EARTH HOUR AND HERITAGE LISTING OF THE NSW NIGHT SKY

I was involved and ran the first Earth Hour program at the Campbelltown Rotary Observatory for members of the public to see the night sky without light pollution. It was absolutely pitch black. Over 300 people turned up at the Observatory. It turned out to be a "wow" experience for them. The Sydney Morning Herald gave us a lot of publicity. Arising from this I got the National Trust of Australia (NSW Branch) to list the night sky over NSW as part of the National Heritage. We were the first country to list the night sky as part of our national heritage. A Member of Parliament from New Zealand came to get advice from me so that they could also heritage list their night sky.

MEDIA MONITORS
INCISIVE INSIGHT

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General News
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■ EARTH HOUR

National Trust sees light on listing stars

Erik Jensen

AN ASTROPHYSICIST from the University of Western Sydney has said stars should be preserved as part of our national identity, and the National Trust has agreed.

When Sydney turns off its lights for Earth Hour next Saturday, the city's sky will be as clear as it was in 1900, Ragbir Bhathal said. The clarity will highlight what light pollution has done to our night sky.

"We have talked so much about carbon emissions we've almost forgotten about the night sky," he said.

Dr Bhathal, who is holding a stargazing session to coincide with Earth Hour, argued that stars form an important part of our national heritage. He said the number of stars visible from the central business district has fallen from 2000 to 100 in the past 100 years.

"Because of the light from big buildings, the whole sky is polluted," he said.

"I think in another 50 to 100 years the whole night sky will disappear like in London or Tokyo. We will lose our national sky heritage."

Dr Bhathal suggested that stars should become a responsibility of the National Trust, as the appearance of the night sky is central to Australia's cultural identity.

The conservation director of the NSW National Trust, Jacqui Goddard, agreed. She said wide expanses of sky were part of what defines Australia aesthetically.

"The night sky is an important part of our heritage – that's why we have the Southern Cross on our flag," she said.

Ms Goddard had not thought about conserving stars before Dr Bhathal's suggestion, but was interested in the possibility of a register to recognise their cultural importance.

"We do list people on the Living National Treasures list," she said. "I don't know whether the stars would be added as such, but maybe the view to the stars from certain places.

"We can't necessarily control the star, but that's not to say that our ability to see the star cannot be protected."

Unlike most environmental degradation, light pollution is instantly reversible.

"The night sky is a natural resource like any other, and we must preserve it," Geoffrey Wyatt, the manager of Sydney Observatory, said. "The Aboriginals have a long connection with the sky, and to damage that is the same as digging up Kakadu."

SYDNEY TURNS OFF THE LIGHTS FOR ONE HOUR

SATURDAY MARCH 31 7.30pm

City glow ... Martin Place lights the centre of this 1933 image. Photo: Herald archives

Penrith City Star

Concerned: Dr Raghir Bhathal, Observatory, UWS Werrington North campus, is worried that light pollution is obscuring the night sky. **Picture: Gene Ramirez**

Switch off and see stars

By **Gemma Seymour**

WHERE would we be had Galileo not looked up at the stars? Or had Newton not pondered gravity and the planets?

We owe a lot to the night sky.

But while celestial bodies are disappearing before our very eyes, there's one thing we can all do to help – flick a switch.

Dr Raghir Bhathal, an astrophysicist at the University of Western Sydney's school of engineering, runs astronomy nights at the observatory in Werrington.

"If you go to Lithgow, with no light pollution, you can see the milky way," Dr Bhathal said.

"It's as if someone took a full pail of milk going up into the heavens and sloshed it.

"If you come to Penrith the milky way is no longer visible."

As for the southern cross, it's losing its radiance and viewers can probably only see three of the five stars.

Dr Bhathal said at the Siding Spring observatory, hundreds of kilometres from Sydney, a haze from the city lights could be seen.

Dr Bhathal was behind the National Trust of Australia (NSW) listing the skies of the state on the trust register in 2008, sparked by the inaugural Earth Hour the year before.

The night sky is "the inheritance of all Australians", the Trust report said. Aboriginal people relied on the sky for navigation, moral teachings and calendars.

Captain's Cook voyage to the south was mainly intended to view the transit of Venus.

"We are the only country in the world where the night sky is heritage listed," Dr Bhathal said.

"Our children here in Penrith can't wonder about the universe [without the stars]."

"The stars are disappearing and so is our heritage."

"If you don't have the stars what can you be curious about? You might as well become a cabbage," he said.

So on Saturday 4000 cities around the world will switch off their lights at 8.30pm for one hour.

Fairfax Media, owner of *Penrith City Star*, is one of the founders of Earth Hour.

EARTH HOUR

Out go the lights!

■ THOSE already behind Earth Hour in Camden:
Camden Council
Macarthur Centre for Sustainable Living
Hope Christian School
Macarthur Square
Pure Living Water
Interface Carpets
University of Western Sydney

■ How to join in:
Sign up on www.earthhour.org and switch off your lights for an hour at 7.30pm this Saturday.

■ What's on around town:
Macarthur Centre for Sustainable Living is running lantern making from noon to 3pm, an organic wine tasting from 6-7pm and a candlelit dinner from 7pm. Dinner guest, Macarthur Sustainable Schools Network chairman Andy Best, will speak on global warming.
Details and bookings for MCSL activities: Lizzie Rose on 4647 6594.

More information: page 104, 105.

Great sight: Dr Ragbir Bhathal, the director of the observatory at the University of Western Sydney, said that the stars over Campbelltown would be far more "spectacular" during Earth Hour when there would be no light pollution to interfere with the view. Picture: Wesley Lonergan

Clear the skies for the children

By **Alicia Bowie**

EVER wanted to know what it was like to stargaze at the start of the previous century?

The University of Western Sydney at Campbelltown is giving you that chance, thanks to Earth Hour this Saturday, March 31.

UWS observatory director Ragbir Bhathal said the darkness in Macarthur that would be the result of people turning off their lights would make for brilliant stargazing.

"At the moment if you go to Sydney Observatory, there are lots and lots of lights because of the large buildings and so on," Dr Bhathal said.

"If you were there in 1900 you probably would have seen about 2000 stars, but if you go there today you'll see about 100.

"That's because of the light pollution.

"It actually fades the whole sky because there's so much light you can't see the stars."

This coming Saturday, all non-essential lighting at UWS campuses will be ceremoniously dimmed as part of the initiative to promote sustainability and reduce greenhouse gas emissions by 5 per cent this year.

One stunning cluster of stars that can be seen from Campbelltown is the Jewel Box.

'Hopefully, it will send them the message that we'd better start looking after our night sky for our children and grandchildren.'
– Dr Ragbir Bhathal

"When looking at it with less light pollution it is much brighter and crisper," Dr Bhathal said.

"It's an open cluster that has a large number of stars that are coloured, so you've got reddish and blueish stars."

Dr Bhathal wants people to come to the stargazing night to see what the night sky would have looked like in 1900.

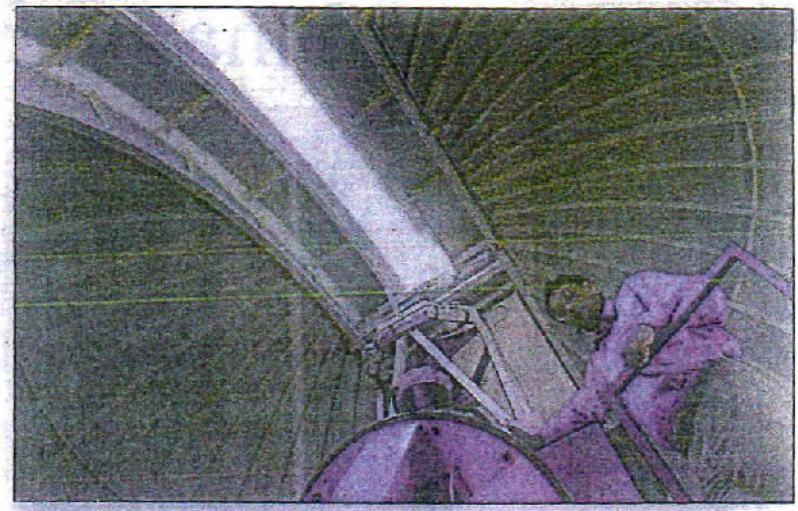
"Hopefully, it will send them the message that we'd better start looking after our night sky for our children and grandchildren, otherwise we'll be like Sydney where we go out in the night sky and can't see anything," he said.

Stargazing for Earth Hour will start at 7pm on Saturday at the Campbelltown campus observatory. Entry is free. Details: Dr Ragbir Bhathal, 4736 0834.

ASTRONOMY NIGHTS AT CAMPBELLTOWN ROTARY OBSERVATORY AND WERRINGTON NORTH OBSERVATORY

Over the last ten years I have been running astronomy nights at the observatories at UWS Campbelltown Campus and UWS Penrith Campus. Over this period about 70,000 visitors have viewed the heavens through the telescopes. Some of Australia's top astronomers have been invited to give public lectures on the latest developments in space and astronomy. I myself gave several lectures as part of the program. We have run special astronomy nights for women, mothers and daughters, fathers, fathers and sons, Rotary Clubs, disabled people, Aboriginal groups who are the traditional owners of the land on which UWS stands, etc. On special astronomical events, such as the closest approach of Mars to the Earth, the Transit of Venus, Alignment of the planets, etc we have had 500 to 700 visitors on a single occasion.

When the University abolished the physics and astronomy degrees, I was pulled out from UWS Campbelltown Campus and asked to teach out the physics and astronomy degree students at the UWS Penrith Campus. In the process I was involved with a technician in repairing and getting the big telescope at the Werrington North Campus into working order so that it could be used by the UWS Penrith astronomy students and also to allow the telescope to be used for running astronomy nights for the public. Getting the big telescope into working order took several months of my time. We had to work several late nights over several months to get the telescope fixed.



STAR GAZING: Dr Ragbir Bhathal is hosting a father and son night at the UWS Observatory.
Photo: DARREN EDWARDS

Boys' night out

THE truth is out there, and we might be closer to finding it than we think.

University of Western Sydney's observatory director Dr Ragbir Bhathal has been studying life in the universe for several years, and has some pretty interesting ideas on the subject.

He'll be sharing these ideas, as well as his telescope, with fathers and sons in a special event on Saturday night.

The night of star gazing and extra terrestrial searching is aimed at sparking an interest in science in young boys.

"There's been a decline in the number of people studying engineering and science of late," Dr Bhathal said.

"In 10 year's time there could be a real shortage in engineers."

The Sons and Dads night is also a chance for fathers to spend some quality time with their sons and grandsons under the stars.

"Astronomy is an excellent way of getting sons and dads to share an evening together at the university's user-friendly observatory," Dr Bhatal said.

A highlight of the night will be the chance to see some of the most spectacular celestial objects in the March night sky, such as the wonderful ringed planet Saturn, the sparkling open cluster 'the Jewel Box' and the 10 billion-year-old globular clusters Omega Centauri and 47 Tucanae.

Dr Bhathal will also be discussing some of the latest information and technologies used to search for intelligent life in the universe.

A similar night for mothers and daughters will be held later in the year.

Sons and Dads night takes place at the UWS Observatory on the Werrington North campus on Saturday night from 8pm to 10pm.

Cost is $12 for adults, $7 concession and $30 for a family.

Bookings are essential, so call 4736 0135.

PENRITH
Press

Vol 52, No 49 | Tuesday, May 28, 2002 | Phone 4731 2700 | Classifieds 13 19 79 (for the cost of a local call) | 65c INCLUDES GST

Time to get the girls stargazing . . . Dr Rogbir Bhathal with astronomy student Melinda Wilson at the UWS Observatory. Photo: DAVID HILL

More women required with stars in their eyes

WE live in the 21st century and in the next 20 years will be colonising the moon and Mars so should start training our future space men and women now. That is the view of UWS astronomer and director of the Nepean observatory Dr Rogbir Bhathal who has organised special astronomy nights for mothers and daughters. The astronomy nights will be held on Fridays from 7pm to 9pm on June 7, 14 and 21 in the Nepean observatory on the UWS campus, Kingswood. Bookings are essential. "Less than five per cent of the 200 professional astronomers in Australia are women, so from an

• To page 2

– Stars in their eyes –

• From page 1

equity point of view, we need to correct this imbalance between the sexes.

"We need to get more girls involved in the study of astronomy, astrobiology and space science engineering," Dr Bhathal said.

First-year astronomy student Melinda Wilson from Woodford will be involved in conducting the mother and daughter nights.

She said astronomy probably appeared to be too daunting for girls which accounted for the low number studying the science.

"You need good HSC marks and a good understanding of physics and maths which might put them off."

A Bachelor of Science (Astronomy) degree required three-years study.

Dr Bhathal said, less than five per cent of the 200 professional astronomers in Australia were women with most of them working for the CSIRO.

"There are going to be plenty of career opportunities in astronomy, astrobiology and space science engineering for women."

The mother/daughter nights will feature short talks and star gazing at some of the oldest stars in the universe.

The telescope at the UWS observatory at 0.6m (24 inches) is the largest in Sydney dedicated to teaching astronomy and can also be used for some research. For bookings phone Roslyn McCourt on 4735 0125.

Cost for the night is $10 adults and $5 students.

why h[illegible]e inte[illegible]n scie[illegible] he replied: "Because someone once showed me the stars."

That philosophy is behind a push by Dr Ragbir Bhathal, director of astronomy at the University of Western Sydney.

Dr Bhathal has developed a special program of astronomy-based activities for local primary schoolchildren.

"The children who become interested in astronomy at an early age are our future scientists, doctors, astronomers, mathematicians and engineers," he said.

The program will run during April at the observatory at the UWS [illegible] what the night sky looked like 2000 years ago and find out how stars are born and how our universe will end.

"The observatory is a tremendous resource for schools in the area," said Dr Bhathal.

Dr Bhathal plans to run astronomy classes for primary school teachers who have to teach astronomy to their pupils, with some of Australia's top astronomers involved.

To book a school visit phone 4736 0135 or email r.mccourt@uws.edu.au

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St Marys Star

www.stmarysstar.com.au

Tuesday, June 11, 2002 | A FAIRFAX COMMUNITY NEWSPAPER | 60 cents (incl GST) | Phone: (02) 4722 7200 | Classifieds: 13 24 25

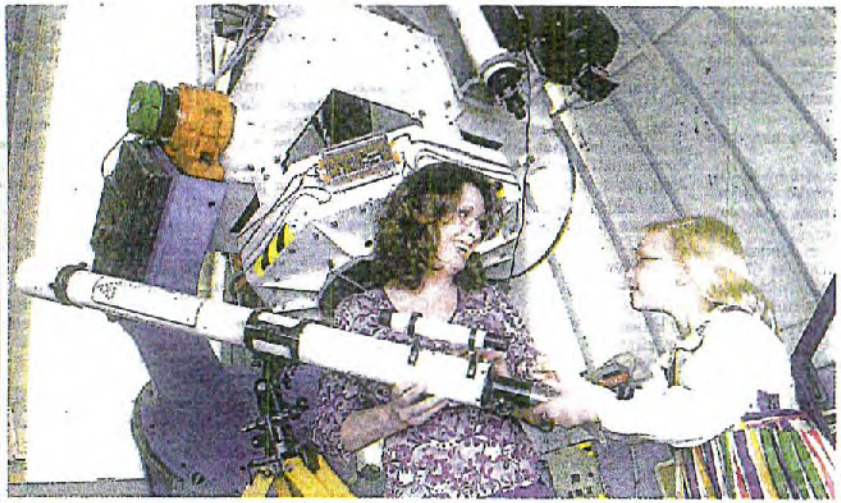
Inside Today

Women at work

SEE PAGE 5

6 Steps to Home Renovation

Women's future is in the stars



STARGAZERS . . . Colyton mum Jackie Newton and daughter Jessica take a look at the great beyond. Photo: GARY WARRICK

THE Nepean Observatory is looking for mums and daughters with a thirst for knowledge.

It has opened its doors to interested local women for two astronomy nights, especially designed for mothers and daughters.

The special events – designed to encourage females to take up science – will be held from 7pm on Friday June 14 and 21.

Program director Dr Ragbir Bhathal said less than 5 per cent of the 200 professional astronomers in Australia were women.

"From an equity point of view we need to correct this imbalance between the sexes," Dr Bhathal said.

"We need more girls involved in the study of astronomy, astrobiology and space science engineering.

"At the moment, we are not tapping the minds of some of our brilliant female students in western Sydney."

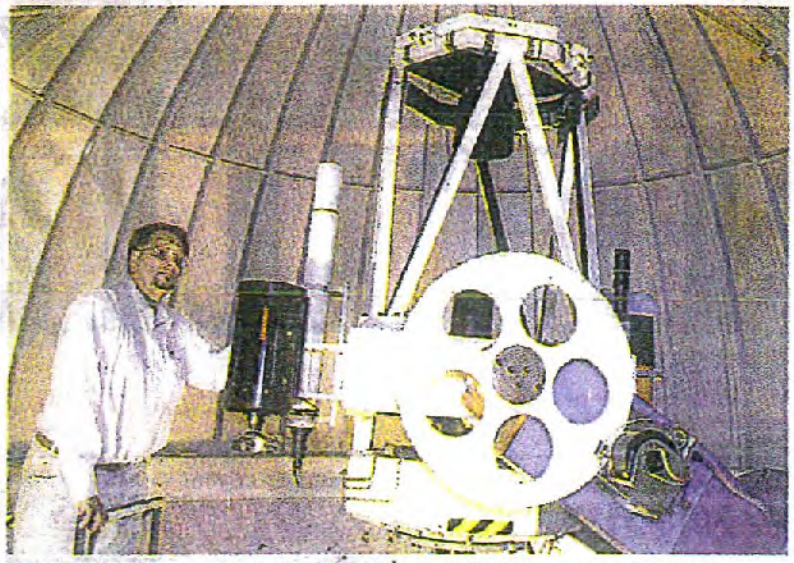
During the program, mums and daughters will be shown how to use a telescope and treated to insights about the night sky and the universe.

Participants will learn about astrobiology, a newly emerging field of study offered at the University of Western Sydney.

The nights will be hosted by experienced stargazers and astronomy guides Melinda Wilson and Stefan Malinowski from the Nepean Observatory.

For bookings, call Roslyn McCourt on 4736 013[illegible]

Penrith City Star, Tuesday, April 9, 2002



STAR GAZING . . . Dr Ragbir Bhathal, at UWS's telescope, gets kids interested in science through astronomy-based activities.
Photo: JASON HAMILTON

Astronomy aimed at schoolchildren

By ANGELA CUMING

WHEN someone once asked the famous scientist Sir Gustav Nossal why he became interested in science he replied: "Because someone once showed me the stars."

That philosophy is behind a push by Dr Ragbir Bhathal, director of astronomy at the University of Western Sydney.

Dr Bhathal has developed a special program of astronomy-based activities for local primary schoolchildren.

"The children who become interested in astronomy at an early age are our future scientists, doctors, astronomers, mathematicians and engineers," he said.

The program will run during April at the observatory at the UWS Werrington campus. Students can use new computer software to take a virtual tour of our solar system and the universe. They will be able to see what the night sky looked like 2000 years ago and find out how stars are born and how our universe will end.

"The observatory is a tremendous resource for schools in the area," said Dr Bhathal.

Dr Bhathal plans to run astronomy classes for primary school teachers who have to teach astronomy to their pupils, with some of Australia's top astronomers involved.

To book a school visit phone 4736 0135 or email r.mccourt@uws.edu.au

Inner West Courier

Astrophysicist Ragbir Bhatal sharing his knowledge of the Australian sky with children at the Sydney Observatory. Photo: Jane Dempster

Astronomical interest

One of Australia's leading astrophysicists, Ragbir Bhatal, will be making his way to Leichhardt next week to teach children how to make their own telescope.

The simple scientific experiment, requiring only a ruler and two types of lenses, is the same type of instrument legendary astronomer Galileo Galilei used and will be one of many astronomy projects Dr Bhatal will show children at a workshop in Shearer's Bookshop.

Dr Bhatal, who is a physics lecturer at the University of Western Sydney, has spent the past decade searching for extra terrestrials.

Dr Bhatal will be at Shearer's to promote his new book, *Australian Backyard Astronomy*. The book is Dr Bhatal's first for children, after writing several books on Australian astronomers and the HSC course book for astronomy.

Dr Bhatal said he had wanted to write the book to inspire children to be curious about the world.

In the last 20 years the number of students studying science and engineering at university had dropped by 30 per cent, Dr Bhatal said.

"This drop is horrifying," he said. "The government needs to introduce more astronomy in schools at an early stage."

Emily O'Keefe

MEDIA MONITORS


Residents sustain their enthusiasm

Penrith Press
29/02/2008
Page: 4
General News
Region: Sydney Circulation: 56913
Type: Suburban
Size: 59.61 sq.cms
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Chance for the boys to check out life on Mars

IS there life on Mars? Fathers and sons will find the answer at the next guys' night out at the University of Western Sydney Observatory on March 8.

During recent years, the red planet has baffled scientists who, believing Earth's closest neighbour contains water, have searched the planet for some form of life. Fathers and sons of all ages will explore these theories and observe the wonders of the night sky through the observatory's computerised telescopes. Observatory director Ragbir Bhathal said stargazing was an excellent way for sons and dads to spend quality time together.

"At this time of the year, it is also an excellent opportunity to see Saturn, the most majestic of the planets in our solar system." The Sons and Dads Astronomy Night will be held at UWS Observatory, Penrith campus (Werrington North) from 8pm on Saturday, March 8. Details: 4736 0135.

They'll be seeing stars

MELISSA MATHESON

THE University of Western Sydney's Observatory is having a boys' night out that's out of this world.

Fathers and sons are invited to a Boys Night Out with the Stars on Saturday, March 4, to discover what's really out there.

"Astronomy is an excellent way for sons and dads to spend quality time together in an exciting evening looking at the wonders of the night sky," Observatory director Dr Ragbir Bhathal said.

The program caters for all ages with grandfathers encouraged to join their grandsons.

Dr Bhathal will host a talk on *Are We Alone in the Universe* with the latest information and technology used to search for everything from microscopic life to intelligent life in the universe.

"Since the 1960s we have taken a scientific approach to the question of the existence of other life-forms in the universe," he said.

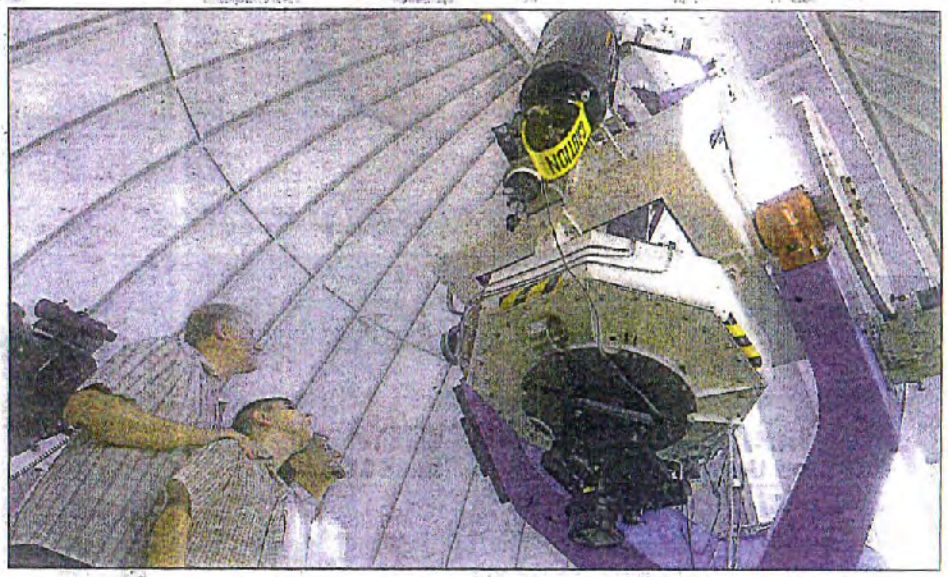
"Modern scientific instruments allow scientists to provide an answer which is based on science and technology rather than mere speculation.

"Using optical, radio and space telescopes and robotic rovers, scientists continue to probe the universe to find out." Astronomy guides will take visitors around the observatory dome, giving them a peek through one of the powerful telescopes to see some of the spectacular young open clusters and 12 billion-year-old global clusters in the night sky.

The Boys Night Out with the Stars is on Saturday, March 4, from 7.30pm to 9.30pm at UWS Observatory, Penrith Campus.

Tickets: $12 adults, $8 children and concession.

For details contact Roslyn McCourt on 4736 0135.



George Caley, 11, and his dad Robert at the UWS Observatory with Professor Ragbir Bhathal.
Picture: DAVID HILL

MEDIA MONITORS
INCISIVE INSIGHT

Macarthur Chronicle
28/11/2006
Page: 34
General News
Region: Sydney Circulation: 71947
Type: Suburban
Size: 201.59 sq.cms
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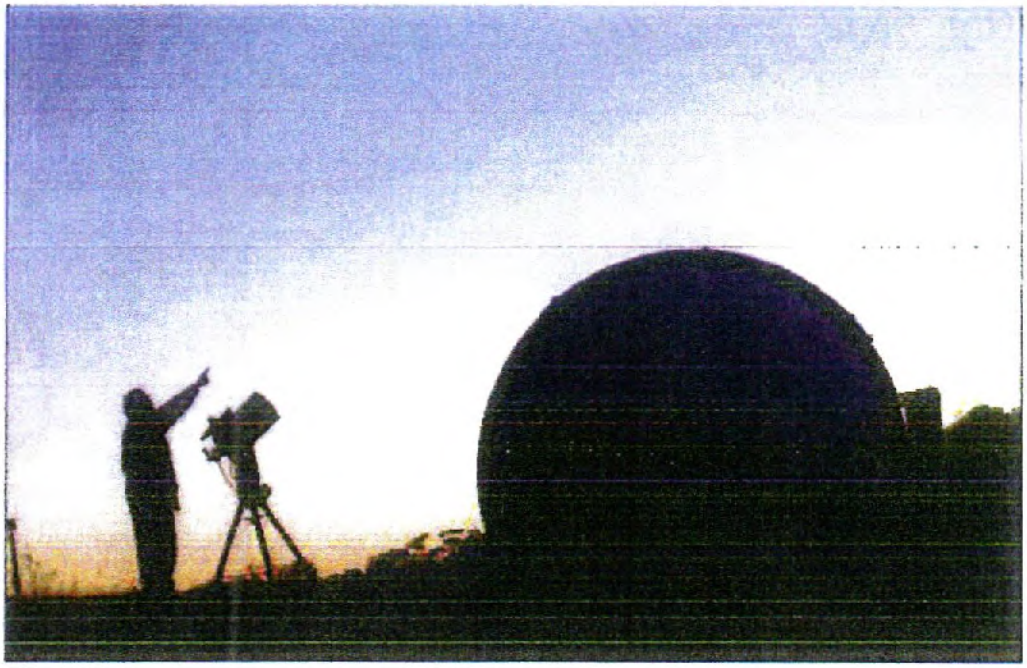

Dr Ragbir Bhathal says stargazing nights spark children's interest in science.

Night's secrets explained

KIDS and big kids alike can find the answers to some of the sky's most baffling questions at the next University of Western Sydney stargazing night.

Learn the facts about the star of Bethlehem, discover what a black hole is and learn the ins and outs of telescopes with Macarthur Astronomical Society at the Campbelltown campus on Friday, December 8.

UWS astronomy director Dr Ragbir Bhathal will lead the stargazing night and is encouraging parents to introduce primary school-aged children to the skies. Dr Bhathal said many a scientific career begun after a child looked through a telescope for the first time.

"At this time of year you can see Uranus," he said. "We'll also be showing globular clusters – including one of the most beautiful clusters in the southern hemisphere called 47 Tucanae, which is named after a South American bird."

He said astronomers would be on hand to answer questions about the advantages and disadvantages of different types of telescopes.

SKY HIGH

- **WHAT:** Stargazing night.
- **WHEN:** Friday, December 8, from 8pm to 10pm.
- **WHERE:** University of Western Sydney, Campbelltown Rotary Observatory, Campbelltown campus, Narellan Rd, Campbelltown.
- **DETAILS:** 4736 0834.

MEDIA MONITORS
INCISIVE INSIGHT

Macarthur Chronicle
21/08/2007
Page: 18
General News
Region: Sydney Circulation: 71947
Type: Suburban
Size: 90.94 sq.cms
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Observatory open for total eclipse of moon

AN eerie darkness is expected to descend on the Macarthur region for two hours next Tuesday night when the moon is completely eclipsed by the sun.

Stargazers are invited to watch the event at the Western Sydney University's Campbelltown observatory.

From 7.50pm, the moon will pass into the Earth's shadow completely obscuring the moon from view across the eastern seaboard.

Total lunar eclipses are relatively common in stargazing terms but are still an awe-inspiring site.

Observatory director Dr Ragbir Bhathal (pictured) and the Macarthur Astronomical Society was hosting a family astronomy night to view the eclipse.

Dr Bhathal said viewers could see the total lunar eclipse with the naked eye until 9.30pm.

"The moon will be eclipsed from about 7.50pm to 9.30pm," he said.

"It is safe to watch the lunar eclipse with the naked eye and members of the public can bring along a camera and binoculars to magnify and improve the view."

The night is free and no bookings are necessary.

The UWS observatory is at the Campbelltown campus, Narellan Rd, Campbelltown.

MEDIA MONITORS

Hawkesbury Gazette
09-Mar-2011
Page: 62
General News
Market: Richmond NSW
Circulation: 7225
Type: Regional
Size: 787.92 sq.cms
Frequency: --W---

5 senses

Immerse yourself in the universe

by Kietley Isrin

EVER wondered what else is out there? Is there really life on Mars?

A family astronomy night at the University of Western Sydney Observatory might just have all the answers.

Hawkesbury families are invited to take part in an outerspace exploration on Saturday, March 12.

Starting at 8pm, Director of the Observatory Dr Raghvir Bhathal will discuss the possibility of life on Mars.

"Mars has fascinated astronomers since the 19th century," Dr Bhathal said.

"Italian astronomer Giovanni Schiaparelli believed that Martians constructed canals on the surface of the planet as a means of spreading."

According to the astronomy expert, Schiaparelli also drew the first maps of Mars and named the geological features with the names from the Bible and ancient mythology.

Dr Bhathal said he will also discuss the latest findings on Mars as well as the future plans by human beings to make it a habitable planet.

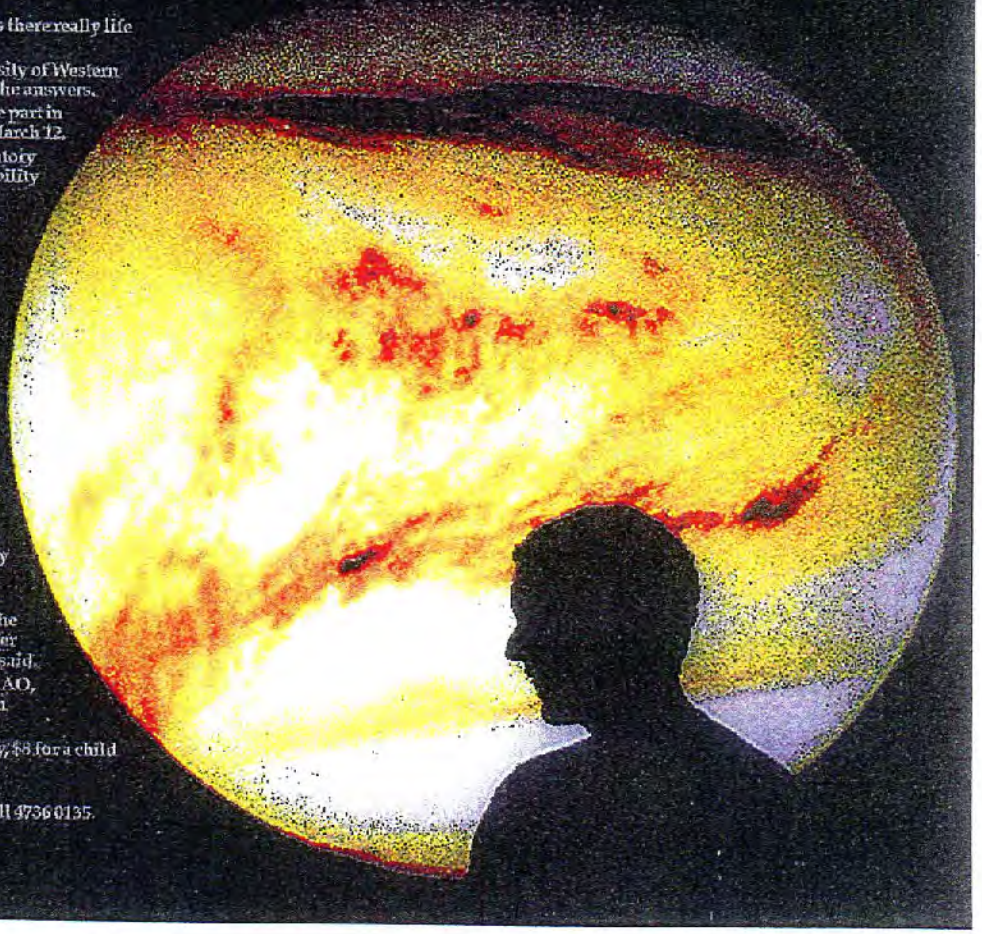
Throughout the evening, guests will have the opportunity to view the night sky through the observatory's computerised telescopes.

"In the autumn night sky, there will be the possibility of viewing Mars as well as other spectacular celestial objects," Dr Bhathal said.

UWS Observatory is located at building AO, Werrington North Campus, Great Western Highway.

A cost of $12 will required for adult entry, $8 for a child and $35 for a family.

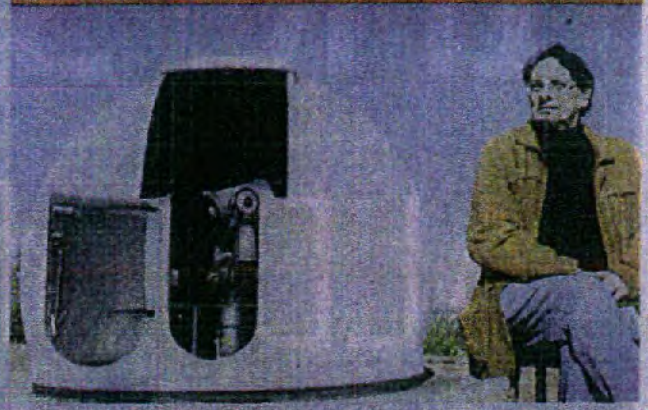
For more information, visit: http://www.uws.edu.au/observatory or call 4736 0135 for bookings.



Waiting for ET's call

By Iliana Stillitano

A JOB LESS ORDINARY



The truth is out there: Astrophysicist Ragbir Bhathal is on a search for extraterrestrial life. Pictured at the University of Western Sydney Macarthur's observatory, Dr Bhathal said equipment designed to search for nanosecond laser pulses that detect extraterrestrial intelligence are becoming more sophisticated and he is certain a discovery will be made in the near future. Picture: Luke Fuda

AS a young boy, Ragbir Bhathal was captivated by the stars and the moon in the night sky.

Like FBI agent Fox Mulder, a young Dr Bhathal spent many nights wondering whether there was life outside the world he knew.

So it's not surprising that years later, Dr Bhathal dedicates his time to searching for extraterrestrial life.

He founded the Searching for Extraterrestrial Intelligence Australia Centre at the University of Western Sydney Macarthur and taught the only university-based course on the subject in Australia.

While that course is no longer offered, Dr Bhathal continues his search for the existence of extraterrestrial life and is writing a book called *The Search of the Century*.

The book explains what is involved in searching for microbial life, searching for Earth-like planets and the implications of discovering that there is life elsewhere in the universe.

"The discovery of a message from extraterrestrial intelligence will be a discovery greater than the discovery of America by Christopher Columbus," Dr Bhathal said.

So big in fact that Dr Bhathal keeps a bottle of champagne in his office ready to celebrate the momentous occasion.

"It would be like cracking the jackpot," he said.

Dr Bhathal counts himself fortunate that his job is also his hobby.

"It's one of the most exciting jobs in science," he said.

From the response he has received from his many books on astronomy, it seems others would agree.

Australian Backyard Astronomy was written to "fire the imagination" of young people by encouraging them to identify constellations from their backyard. It sold out after three months and was reprinted.

Another book on Australian astronomers and their achievements made the best-sellers list.

"People are very curious, particularly kids," he said.

"I'm still surprised when I hear people say they haven't seen the moon through a telescope.

"When you look through a telescope you can see craters in the moon and that's a real wow factor for kids.

"My word, you have to see them."

Macarthur - Towards 2000

Research is vital

The truth is out there . . . Dr Ragbir Bhathal at UWS Macarthur's astronomy dome. The new facility will be a crucial part of the university's space research

EDUCATION

THE University of Western Sydney Macarthur's mission is to provide teaching and learning and to undertake research both of which are of the highest international standard and are vital to the future of Australia and especially south-western Sydney.

UWS Macarthur is where people design their future and meet its challenges.

To encourage this it has distilled a range of primary goals for its 1999 to 2003 strategic plan. The university is committed to producing graduates for the Third Millennium who combine generic knowledge with applied professional skills.

By 2004 it is expected that employers, students and academics will identify UWS Macarthur as a university that is globally focused and locally relevant. The university is developing as a multicultural centre of scholarship that nurtures an international perspective with teaching research programs utilising resources, expertise and communication from across the world.

International collaboration, linkages and exchanges are being rapidly expanded.

Another goal is to adopt a dynamic approach to interacting with and forming partnerships with south-western Sydney communities. The aim is to enhance local development and educational opportunities, including the establishment of both programs linking schools and TAFE to the university.

It is believed that by 2004 UWS Macarthur will be recognised as a significant research university in its chosen fields of research.

MACARTHUR Chronicle

PHONE (02) 4626 5288 TUESDAY, SEPTEMBER 2, 2003 44c incl. GST

Mars show dazzles earthlings

MARS put on a perfect show last week as hundreds of earthlings [illegible] opportunity to see the red planet.

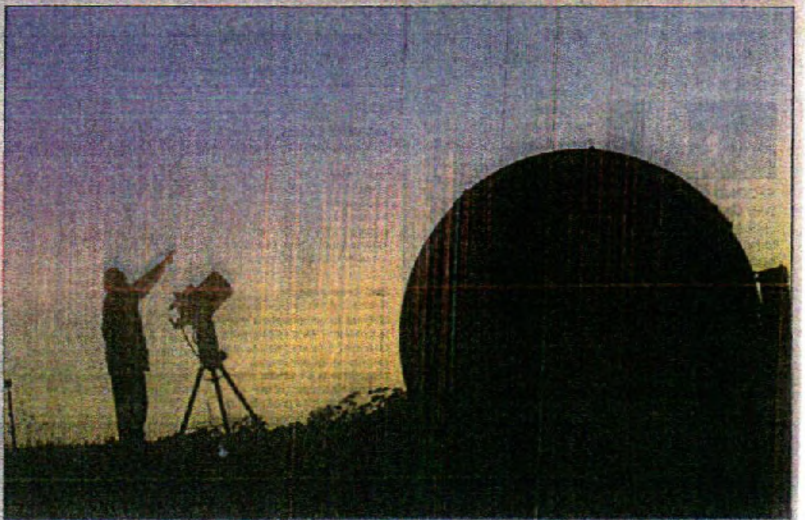
People [illegible] hours at [illegible] observatories to catch a glimpse of [illegible] won't be seen again for [illegible] years.

University of Western Sydney [illegible] Dr Ragbir Bhathal said seeing Mars so close to Earth was a priceless experience. "It was the size of a five-cent piece through the telescope and I could see the markings of Mars and the icecaps," he said.

"The reaction from people who had lined up for hours to see it was amazing too."

Dr Bhathal said many of his science students were awed at the beauty of the mysterious planet. "We will be talking about this in class for weeks," he said. The final Mars viewing will be held on Saturday night at the Campbelltown Observatory.

Details: 4736 0823.



DAZZLING SHOW. Dr Ragbir Bhathal scans the skies for a view of Mars. Photo: ROBERT POZO

Flash in the pan may be messages from outer space

Richard Macey

A Sydney astronomer is watching the skies for aliens he suspects may be flashing at us.

Since 1960, scientists involved in the now international Search for Extraterrestrial Intelligence (SETI) have been using radio-telescopes to listen for signals that will tell us we are not alone.

But so far the hunt has been fruitless, turning up just occasional false alarms triggered by stray radio interference from man-made gadgets.

An astrophysicist at the Campbelltown campus of the University of Western Sydney, Dr Raghir Bhathal, believes the problem is that alien civilisations may be so advanced they have abandoned radio in favour of more sophisticated forms of communication.

"On Earth, we are already moving away from communicating by radio to optical communication with fibre optics and lasers," he said. "By 2050 most of our communications will use light which can carry hundreds of thousands of times more information than a radio signal."

He said that during US President Reagan's failed Star Wars military program of the 1980s scientists designed high energy lasers which could produce nanosecond light pulses.

Studies showed that pulses from extremely powerful lasers placed 100 to 1,000 light years away could be easily detected by a telescope and sensitive detectors. "The flashes would outshine a sun-like star," said Dr Bhathal, who believes aliens could already be using lasers to signal their position.

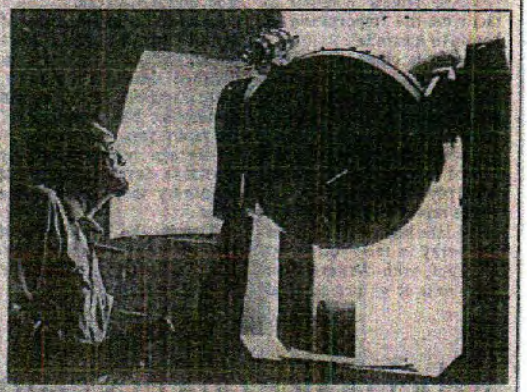
So, whenever Campbelltown's nights are clear, Dr Bhathal, director of the Australian Optical SETI project, or Oz Oseti, is in the university observatory using its twin telescopes to scan the skies for flashing stars.

He has chosen 200 sun-like stars within 100 light years of Earth to watch. He spends up to five hours a night, observing from five to 10 stars. "So far we have looked at 120 stars," he said. "We haven't found anything at all." He hopes to have examined all 200 within six months, before expanding his search to include 10,000 stars out to 1,000 light years.

He was confident any light signal should be unmistakable. If one telescope spots a flash he will check what the second saw. If both record a flash he will be confident it was a real event, not a technical glitch.

Dr Bhathal believes intelligent civilisations must be out there, despite being hard to find. "Look at how many millions of stars there are in the universe. It is unreasonable to expect there is no life on any of them."

Even if he spots a flashing star, he has no plans to flash back. "It's a search strategy," he said. "Not a reply strategy."

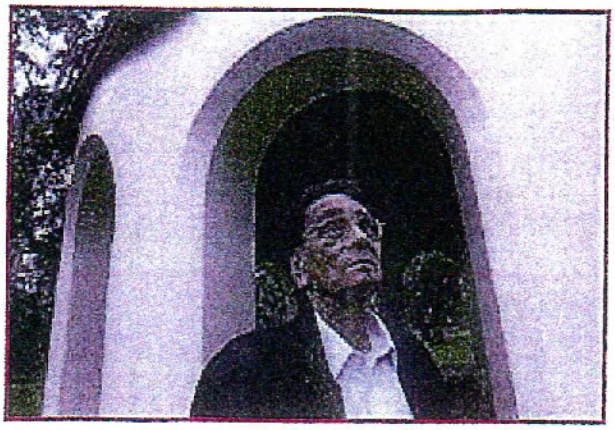


Dr Bhathal watches and waits for a sign. Photo: Laura Friezer

The Sydney Morning Herald | News 7 | Wednesday, March 7, 2001

NEWS WATCH

BRINGING NEWS ABOUT PROMINENT AUSTRALIANS



Twenty telescopes searching the heavens

BY JADE WITTMANN
26 Apr, 2012 12:00 AM
PARRAMATTA Observatory should be a star on the world heritage list of astronomical institutes, a local physicist says.

Two stone pillars at the southern end of Parramatta Park are all that remain of the observatory — part of the original transit circle telescope stones used inside the domes of the venue — built privately in 1822 by NSW Governor Thomas Brisbane and turned over to the government in 1826.

An astrophysicist at The University of Western Sydney, Ragbir Bathal, will outline the achievements of the observatory during an evening of stargazing at Parramatta Park on Saturday.

Dr Bathal said Encke's Comet was observed for the first time in the southern hemisphere from the site and affirmed a key scientific theory in the process.

"One of the major achievements of the observatory was that it produced a confirmation of Newton's theory of gravitation," he said.

More than 7000 stars were also recorded in a catalogue at the observatory, though errors were found due to damage sustained by the equipment used during transit from England.

Amateur astronomical societies will provide up to 20 telescopes so these stars and others can be observed, or attendees can bring their own telescope and get pointers from fellow enthusiasts.

The telescopes will be set up on Salter's Field, with free talks in the Parramatta Park Cafe and Event Centre.

Dr Bathal said his favourite constellation is the jewel box, a cluster of diamond-like red, blue and pink tinged stars discovered by 19th century South African astronomer John Herschell.

He said stargazing provided a sense of wonder, particularly for younger people.

"We need more scientists in the younger generation and astronomy is one of the best ways to introduce kids to the areas of science and technology and medicine," he said.

Parramatta Park

DON'T MISS

CHILDREN'S ASTRONOMY NIGHT

● University of Western Sydney Observatory, Great Western Highway, Werrington North; today 7pm-9pm, adult $12, child $8, family $36, 4736 0135

Ever wanted to get a good glimpse of the solar system? Enjoy some spectacular stargazing through the university's computerised telescopes at this special night for children. See Saturn, listen to a talk and take part in fun science activities.

hone 9288 2539 or email pleffera@dailytelegraph.com.au

HORSE STUNT SHOW

● EQ, Moore Park; tomorrow 10.30am, 12.30pm, 2.30pm, free, 8117 6700, eqmoorepark.com.au

Watch amazing horseback stunts usually only seen in the movies. During the hour-long show, 15 riders perform some impressive tricks with 10 horses in the arena. Trainer Heath Harris gives the crowd an insight into how horses are trained for film and TV. And the horses won't be the only animals bringing smiles to children's faces. The Kindifarm offers some cute and furry farmyard animals to admire and hold. Watch sheep being shorn, pat a calf or lamb and feed piglets (11am-3pm, $5). From Monday through to next Saturday there will also be a Walkabout Reptile Show with snakes, lizards, frogs and a baby crocodile (11am-1pm, free).

CHILDREN'S BOOKS

● Festival Of Children's Literature, Norman Lindsay Gallery, 14 Norman Lindsay Cres, Faulconbridge; today and tomorrow 10am-4pm, free, 4751 1067, www.normanlindsay.com.au

Young imaginations can go on a real journey at the eighth Festival Of Children's Literature. Children of all ages can enjoy storytelling, arts and craft workshops and meet some of the leading names in children's literature, such as Emily Rodda (tomorrow at noon). Other popular authors to stop by over the weekend include Gabrielle Lord, Simon French, Donna Rawlins, Chris Cheng, Tohby Riddle, Mark Macleod and Alan Lloyd. There also will be face-painting and guided walks.

PUBLIC LECTURES AND SEMINARS ON

POPULARISATION OF ASTRONOMY TO THE PUBLIC

I have also been actively involved in giving public lectures not only on astronomy nights but also to schools, community groups, Aboriginal community groups, Rotary Clubs, business groups and scientific societies. I have also run seminars on astronomy education and the popularisation of astronomy to the public.

I have also been invited to give public lectures in overseas countries. For example, I have given public lectures at the Sonnenberg Observatory at the University of Utrecht, one of the oldest universities in Europe. I was also invited to give a public talk on Aboriginal Astronomy at the Utrecht Aboriginal Art Museum. The lecture/reception was hosted by the Australian Embassy in the Netherlands. As a result of this talk the Embassy invited me to give a similar talk to the diplomats in the Hague. In 2009, which was the UN International Year of Astronomy I was invited to give a lecture on improving the scientific literacy of Aboriginal students through physics and astronomy. The lecture was published in the proceedings of the conference by Cambridge University Press. The conference was organised by UNESCO and the International Astronomical Union (IAU) and held at the UNESCO Headquarters in Paris. For the International Year of Astronomy I gave several talks to community groups at their Council Libraries in the western and southern suburbs of Sydney.

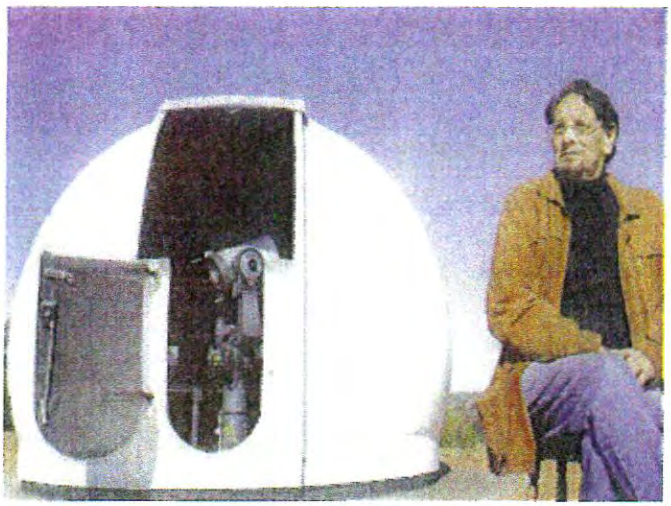
PUBLIC LECTURE

SONNENBERG OBSERVATORY

UNIVERSITY OF URECHT, UTRECHT

MONDAY 9 JANUARY 2012

6 PM TO 8 PM.



SEARCHING FOR LIFE IN THE UNIVERSE

DR RAGBIR BHATHAL

UNIVERSITY OF WESTERN SYDNEY, AUSTRALIA

Are we alone in the universe is one of the most intriguing questions asked by human beings since time immemorial. Since the 1960s astronomers and scientists have been observing the heavens and carrying out experiments to answer this question. Dr Ragbir Bhathal who carries out the only dedicated optical SETI experiment from the southern hemisphere will discuss the latest findings in the search for life in the universe. According to Karl Gauss, the great 19th century mathematician and physicist the discovery of a signal from ET will be a discovery greater than the discovery of America.

PUBLIC LECTURE

ABORIGINAL ART MUSEUM

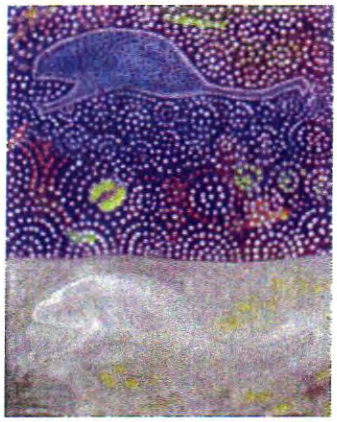
UTRECHT, NETHERLANDS

TUESDAY 18 DECEMBER 2011

7 PM TO 9 PM

RECEPTION HOSTED BY

THE AUSTRALIAN EMBASSY, NETHERLANDS



40 000 YEARS OF ABORIGINAL ASTRONOMY

DR RAGBIR BHATHAL

UNIVERSITY OF WESTERN SYDNEY, AUSTRALIA

The Aboriginal people have been observing the night sky for over 40 000 years. In that period of time they have built up an extensive knowledge of the universe they live in. This fascinating talk will explore the astronomical knowledge system of the Aboriginal people of Australia and show how they have incorporated this in their social and cultural life. It will also discuss how a knowledge of the constellations helped the Torres Strait Islanders win their land rights case in the High Court of Australia.

Dr Ragbir Bhathal is an award winning author and has written 15 books of which two are on Aboriginal astronomy. He is conducting a national project on Aboriginal astronomy. He was awarded the 1988 Royal Society of NSW medal for services to science and research.

GUEST LECTURE

PERSPECTIVES ON ABORIGINAL ASTRONOMY

BY

DR RAGBIR BHATHAL

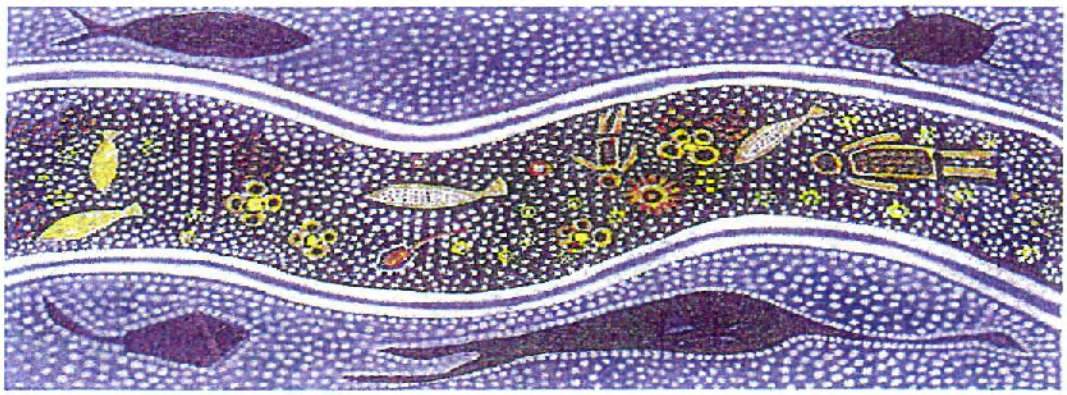
UNIVERSITY OF WESTERN SYDNEY

VISITING FELLOW, RESEARCH SCHOOL OF ASTRONOMY & ASTROPHYSICS, AUSTRALIAN NATIONAL UNIVERSITY

WEBSTER THEATRE A

UNIVERSITY OF NEW SOUTH WALES

17 MAY 2012 : 4 PM – 6 PM



The Aboriginal people of Australia have been observing the night sky for over 40,000 years. In that period of time they have not only built an extensive knowledge system of the night sky but have created some fascinating stories about the celestial objects. They came up with the remarkable concept that the laws in the heavens are similar to those on the land long before English physicist Isaac Newton enunciated this law in his theory of gravitation in the 17th century. Their dual concept of the law of the land and the heavens had tremendous implications for Australian society in the second half of the 20th century. Dr Bhathal's fascinating talk will discuss various perspectives on Aboriginal astronomy.

Dr Ragbir Bhathal is an award winning author and an astrophysicist who has written eight books on astronomy including two books on Aboriginal astronomy. He is conducting a National Project on Aboriginal Astronomy. He was awarded the CJ Dennis Award for excellence in natural history writing and the prestigious Nancy Keesing Fellowship by the State Library of NSW and the Royal Society of NSW Medal for services to science and research.

ORGANISED BY THE NURA GILI RESOURCE CENTRE, UNIVERSITY OF NEW SOUTH WALES

OUR PLACE IN SPACE
UNDER THE SOUTHERN CROSS
2009 Heritage Forum

Campbelltown Arts Centre presents an evening of personal stories and professional endeavours that look to the past, present and future of Campbelltown and the cosmos.

Two short films present very different perspectives on *'Our Place in Space'* recognising the importance of individual experiences and attitudes in our changing universe. As we celebrate the 40th anniversary of the moon landing, documentary filmmaker Abigail Moncrieff will present stories from Campbelltown residents who recall their own memories of this historic event. Artist and filmmaker Kate Murphy will explore the phenomenon of UFOs with the local pioneers of the paranormal, UFO-PRSA.

The University of Western Sydney's renowned Astrophysicist Dr Ragbir Bhathal will deliver the key note address at the Heritage Forum and return on Saturday 18 April for a stimulating public lecture on his groundbreaking optical search for extraterrestrial life.

Campbelltown Arts Centre
Friday 17 April 7pm
Guest Speakers: Dr Ragbir Bhathal, University of Western Sydney
Filmmakers: Abigail Moncrieff, Kate Murphy
Free. Bookings essential. Refreshments provided
P 4645 4100 **E** artscentre@campbelltown.nsw.gov.au

SEMINAR ON ASTRONOMY EDUCATION

SATURDAY 8 DECEMBER 2007

Drawing of Southern Cross by Andrea Corsali 1515.
Mitchell Library.

UWS OBSERVATORY
WERRINGTON NORTH CAMPUS
UNIVERSITY OF WESTERN SYDNEY

9 AM TO 5.15 PM

ORGANISED BY DR RAGBIR BHATHAL.

ATTENDED BY ACADEMICS, TEACHERS AND AMATEUR ASTRONOMERS INTERESTED IN GETTING STUDENTS TO TAKE UP CAREERS IN ENGINEERING PHYSICS AND SCIENCE.

PARTICIPANTS FROM AUSTRALIA AND NEW ZEALAND.

National Science Festival attracts a wealth of inquiring minds

By NAOMI MAPSTONE, Education Reporter

The "simple curiosity of a child" is the impulse which drove many of Australia's greatest scientists to make their greatest discoveries, the author of a new book, *Australian Astronomers*, said yesterday.

And he should know.

Dr Ragbir Bhatal, an award-winning physicist and writer, interviewed Australia's top astronomers for the book that Sir Gustav Nossal will launch in Canberra next week and he has embarked on interviews with 100 Australian women scientists for another.

He said all scientists were born with a fascination for the natural world and when it came to astronomy, the scientific world's fascination was shared by poets, writers, mathematicians, artists and dreamers of all kinds.

In an address to a Canberra audience this week as part of the National Science Festival, Dr Bhatal recalled the words of 13th century Chinese poet Teng Mu and 16th century Italian poet Ludovico Aristo, who both envisaged worlds other than our own.

"How unreasonable it would be to suppose that besides the heaven and earth which we can see there are no other heavens and no other earths," Teng Mu said.

Aristo's epic, *Orlando Furioso*, had one of his characters travel to the moon in a chariot that carried the prophet Elijah in a whirlwind to heaven.

Dr Bhatal said the last frontier for humans was the search for extra terrestrial intelligence.

Since the 19th century, when the German mathematician Gauss suggested planting a large triangular wheat crop to signal the Earth's presence to other life forms, we have made many advances in our approaches to extra terrestrial life, he said.

He said we have sent messages via radio and electromagnetic waves and used space crafts to carry written messages and maps, photographs, music, spoken greetings from various countries and even the sounds of humpback whales, a kiss and a heartbeat.

The change from sending our own messages to listening for theirs — which has occurred over the past two decades — is a significant one, he said.

So far we have not picked up any signals. But if you ask Dr Bhatal, one day we will.

"I think personally there is life out there somewhere in the universe. I can't imagine there not being."

Picture: GARY SCHAFER

Award-winning physicist and writer, Dr Ragbir Bhatal, casts an eye over a Newtonian reflector telescope.

AUSTRALIAN SCIENCE Festival

• APRIL 20 - APRIL 28, 1996 •

• CANBERRA •

TODAY

9am-5pm: Careers in science. Special festival display at the Canberra Careers Reference Centre. Free.

9am: Parliament House. See the changing of the flag. Free.

Questacon's Festival Internet Challenge: find out the details on Questacon's web site (http://sunsite.anu.edu.au/Questacon).

Gene Technology at the Green Machine. Supervised classes looking at DNA extraction and techniques of genetic engineering. At CSIRO Division of Plant Industry. $45 a person for three-hour session. Bookings essential.

Cockington Green. Times by arrangement. Learn the techniques of model making. Bookings essential.

9am-5pm: Display on exploring ecosystems. Presented by Tidbinbilla Nature Reserve and Namadgi National Park.

9am-5pm: Take a two-hour tour of the Lower Molonglo Water Quality Control Centre. Bookings essential. Free.

9am-10pm: High-tech scientific displays. Telstra Tower. Adults $2, children $1.

9am-5pm: View material from the National Library's collections relating to the lives and works of Australian astronomers. National Library. Free.

10am-5pm: Madlab is at Questacon. A workshop where kids make their own electronic circuits. Bookings essential.

10am-11.30am: Find out what goes on under Parliament House. Bookings essential. Free.

10am-5pm: Yarramundi Environmental Discovery Trail. National Museum of Australia. Free.

8pm: Laser ranging demonstration at Orroral Geodetic Observatory. See how the distance between satellites and earth is measured by lasers. Bookings essential. Free.

Plus Starlab Planetarium at Canberra Deep Space Communication Complex; the Whale at Questacon; Science and Technology Bicycle Trail; [illegible] at Casino; 50 years of Photography at the Film and Sound Archive; Electoral Education Centre.

TOMORROW

10am-4pm: Australia's inaugural international solar and advanced technology boat race on Lake Burley Griffin. 20 boats from Australia, Germany and Denmark line up for the Kingston Foreshore Technology Race. Boats start and finish at Grevillea Park. Public can view the race from any of the usual vantage points around the lake. Free.

10am-5pm: Questacon-The Canberra Times half-price day. Double the fun for the entire family. Half-price.

10am-5pm: Madlab, the workshop where children make and take home their own electric circuit boards is at Questacon. Small charge.

9am-5pm: Demonstrations and displays of satellite imagery, mapping using Geographic Information Systems and satellite navigation using Global Positioning Systems. AUSLIG Open Day. Fern Park. Free.

8.30am-5pm: Day tour taking a look at the rocks and fossils of the Canberra region. Gondwana Dreaming Tours. Bookings essential.

9am-5pm: The lives and works of Australia's internationally renowned astronomers. National Library. Free.

9am-5pm: Visit the Australian Federal Police Museum and firing range, Weston. Bookings essential. Free.

9am-4pm: Take a two-hour tour of the sewerage works at ACTEW's Lower Molonglo Water Quality Control Centre. Bookings essential. Free.

10am-5pm: Follow the Environmental Discovery Trail at Yarramundi Reach. 11am: Special extended tour of Carey's Cave, Wee Jasper. Bookings essential. Adults $8, Children $4.50.

Plus: Bicycle Technology at the Canberra Bicycle Museum; Bywong Town Old Gold Mine; Canberra Railway Museum; make your own coin at the Mint; Canowindra Fish Fossils; Electoral Education Centre and Telstra Tower.

Phone [illegible] for further information.

The Making of Australian Astronomers

by Ragbir Bhathal

Ragbir Bhathal pays tribute to the high priests.

Australia is a world leader in astronomy. This eminent position has been gained through the work of a few brilliant astronomers who have scaled the heights of international astronomy. Their scientific achievements were published in my book Australian Astronomers which was placed on the best seller list when it was first published in 1996.

The contributions of this remarkable group of Australian astronomers have been recognized by their peers. They are either Fellows of the Royal Society of London and/or the national science academies in the USA and Australia. Two of them (Ron Ekers and Richard Manchester of the Australian Telescope National Facility) have just been awarded the Australian Government's prestigious Federation Fellowships each worth $250,000.

Who are these astronomers and how did they become prominent was the subject of a recent study that I carried out as part of a national project on elite scientists in Australia. Eighteen of Australia's top astronomers [Bart Bok, Ronald Giovanelli, Chris Christiansen, Ben Gascoigne, Paul Wild, John Bolton, Hanbury Brown, Richard Manchester, Russell Cannon, Ron Ekers, Jeremy Mould, Harry Minnett, Bernard Mills, Ronald Brown, Donald Mathewson, Ken Freeman, Donald Melrose and Robert Frater] were interviewed a few years ago to find out what elements entered into making them eminent. Were there special qualities of personality, home background or upbringing that mark a person for this calling or did they become astronomers by chance or by force of circumstances? Did they muck around with telescopes or things of a scientific nature and did they show an interest in astronomy when they were young, etc.

The results of the study were surprising but it also confirmed some of the findings of a study carried out by Harriet Zuckerman on the American scientific elite. Some aspects of this study are highlighted below.

The majority came from middle class or professional homes where money, although not in plentiful supply, was sufficient for a comfortable life and for providing access to a good education. Slightly less than half went to private schools. According to Ken Freeman, a Fellow of the Royal Society of London, "My family was relatively well to do, there was money to send my sister and me to private schools, with some sacrifice." As young boys they mucked around with scientific and technical gadgets. Most of them had a happy childhood, unlike creative intellectuals in the humanities and in the world of art.

Except for Freeman, Giovanelli, Bok and Christiansen who came from continental European backgrounds, the rest came from Anglo-Celtic protestant backgrounds. Only a couple came from Catholic backgrounds. Unlike the American scientific elite there were no astronomers from Jewish backgrounds. This is partly because most prominent Jewish scientists from Europe settled in the United States; very few ventured to Australia. Most of the astronomers came from families that were not religious in the formal institutional sense. This meant that there was enough freedom for the expression of diverse views in the home which seems to be a prerequisite for a growing scientific mind. A couple of the astronomers see religion as having had an adverse impact on science. Don Matthewson, a former director of the Mount Stromlo and Siding Spring Observatories said, "I think religion has set back science enormously. So it has been a bad impact. I think the dogmatic teachings and the [fact] that they burnt a few astronomers at the stake... shows that the church is restrictive on free thinking."

It is rather surprising to note that most of the astronomers did not show any interest in astronomy in their secondary schools years. Their decision to become professional astronomers was usually not made until they were in their third or fourth year at university. They became astronomers by chance, force of circumstances or were influenced to take up astronomy by attending a summer science school and in a couple of cases, after having completed a PhD in a different area of physics. "Pawsey gave me the choice of either continuing with the computer or doing astronomy. At the time Bolton had made his first discovery of point radio sources, and this really intrigued me. So, as far as I was concerned, there was no choice, I went into astronomy, although I was by no means an astronomer," said Bernard Mills, the inventor of the innovative Mills Cross.

Just as in the study of the American scientific elite, the importance of mentors was extremely important for their progression up the ladder of international recognition. According to Freeman, "contact with Sandage - was very good for my career... Sandage became a mentor and a patron and has helped my career greatly."

All the eighteen astronomers established linkages not only amongst themselves but also with the international world of astronomers. They are a small select group of elite astronomers in Australia with international links. They also belong to the international 'invisible college' of elite scientists. They are the gatekeepers and high priests of Australian astronomy. *MT8-08*

MEDIA INTERVIEWS AND APPEARANCE ON TV AND RADIO

I have appeared on the ABC Catalyst Science Show, SBS World News, BBC, TVS, Channel 9 and Radio National. From time to time I have been interviewed on the local radio on scientific topics.

STORY ARCHIVE

Seeking Extra Terrestrial Light

(18/10/2001)

DR RAGBIR BHATHAL ON LASER SEARCH FOR ETI

The latest thinking in the search for extraterrestrial intelligence is that we should be looking for laser beams instead of radio waves from deep space. Astronomers have been searching the skies for extraterrestrial radio signals for four decades now, but they've found nothing.

A University of Western Sydney researcher thinks he knows why - scientists have been looking in the wrong place. He doesn't think ET would signal us with radio waves; he says an alien is more likely to try to attract our attention by flashing powerful laser beams in our direction. Laser beams many times brighter than our own star.

TRANSCRIPT

Narration: If you yearn to know if there is intelligence out there in the universe, you'll be happy to learn that Australia is a hotbed of extraterrestrial activity at the moment.

Graham Phillips: I was going to say - I think we've got something here.

Narration: And that's the problem for SETI - the search for extraterrestrial intelligence. After 40 years of searching, every interesting signal has turned out to be a false alarm. If the galaxy is teeming with talkative aliens, why can't we find them? Another Australian astronomer, thinks he has the answer.

Could the reason that we haven't found ET yet be that we're not looking in the right place? Rather than sending radio messages, he could be flashing powerful light beams in our direction - laser beams, according to some scientists. That's what this telescope's searching for - extra terrestrial light signals.

Narration: Tonight, like almost every night, Ragbir Barthal points his optical telescope at a promising looking star - a star like our sun. If ET is flashing laser beams at us, we should see them in the star's light.

Graham Phillips: So the light comes down the telescope, through the optic fibre cable into the detector and what we see it in the computer here do we?

Graham Phillips: We've got the signal here.

Dr Ragbir Bhathal: Yes we've got the signal here but what you're looking at there is the drumbeat of the starlight. Now if there was an ETI signal we wouldn't get this type of signal we'd get a very sharp pulse, and they'd be regular.

Narration: Ragbir's convinced ET is likely to signal us with light.

Dr Ragbir Bhathal: The reason why light is better than radio waves is because light waves carry more information - 100,000 times more information.

Narration: And a galactic civilisation could make a very powerful laser beam, calculates Ragbir - one many millions of times brighter than its own star.

Dr Ragbir Bhathal: If you're looking now at very advanced civilisations. I mean if they haven't done that there's something wrong. (Laughs)

Narration: But here's a thought - everyone's assuming there is must be intelligence out there somewhere. What if there isn't? Scientists are now debating the possibility.

Dr Charles Lineweaver: Do I think that there are intelligent extraterrestrials with radio telescopes out there? No I don't. I have very strong doubts that there are.

Graham Phillips: What none in the entire universe?

Dr Charles Lineweaver: Yes that's right.

Narration: Lineweaver says there's nothing special about intelligence - we just think it's the pinnacle of evolution because we have it - and therefore assume it exists throughout the universe. But the biologists say it's a one-off, the chance of fluking intelligence on other planets is about as likely as fluking elephants.

Dr Charles Lineweaver: You can imagine an elephant. I have a very long nose and it's such a great thing. I can pick up peanuts. I can pull down trees. I can do all kinds of things. Surely this is something that's so useful you'd expect it to evolve everywhere, any species should have evolved towards something like me and yet I think as a non-elephant you can see that that's probably a vain position, a little bit egotistical.

Narration: Lineweaver points out: every one of the billions of other species that have lived on Earth have got by just fine without intelligence. So will alien life-forms.

Of course the debate will go on until we find a signal or give up. But what a frightening thought - that we're the only intelligence in the universe, and that this is good as it gets.

Topics: Space

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Related Info

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