

GREENING THE UNIVERSE

'Space junk reaches new levels.' 'Endangered squirrels under threat from observatory.' 'Nuclear reactor sent into space.' 'Toxic rocket fuel found down-range of launch site.' with headlines like these, you might be forgiven for thinking astronomy and space exploration is pretty hard on the environment. Not so, argues astronomer Fred Watson in this provocative and entertaining talk. When the big picture is taken into account, the credentials of these high-tech sciences are greener than you might imagine. At least, as far as life on planet earth is concerned...

WHY IS URANUS UPSIDE DOWN?

Over the past few years, robotic spacecraft from earth have made ever deeper forays in the field of planetary exploration. We now have unprecedented insight into the geological history of mars, and astonishing new surveys of the bizarre moons of Saturn. Moreover, we stand on the brink of exciting new discoveries from mercury, Venus, mars and, in a few years' time, Pluto. What is driving this feverish activity to understand the nature of the solar system? Using the latest amazing images from mars, Saturn and other corners of the sun's family, Fred Watson spells out the motivation for these investigations.... And reveals just why Uranus is upside down.

TOURISM'S FINAL FRONTIER

The turn of the millennium has brought a new dimension to the space age - one that was undreamed of only a few years ago. Thanks to a combination of visionary entrepreneurs and an ailing Russian spaceflight programme, space tourism is now a reality that is set to take off dramatically in the near future. In this entertaining and fully-illustrated talk, Fred Watson outlines what we might see as space tourism evolves into a mainstream branch of the industry.

He argues that the new venture is not merely an expensive diversion for the very rich, but a necessary step in humankind's emergence as a space-faring species.

NAVIGATION AND THE INTERPLANETARY SUPERHIGHWAY

Navigating the earth's oceans by the stars was one of the earliest practical uses of astronomy. Today, our exploration of our environment has extended beyond the earth's surface to the solar system and beyond. Thanks to the effectiveness of modern supercomputers, astronomers can now chart a complex and ever-changing network of imaginary tubes that represent pathways between the planets of the solar system. This 'interplanetary superhighway' is the key to our continuing exploration of the solar system.

In this entertaining and fully-illustrated talk, Fred Watson brings the interplanetary superhighway to life, and illustrates how it is being used to navigate spacecraft around every corner of the solar system, from mercury to Pluto and beyond.

ASTRONOMERS BEHAVING BADLY

Today's picture of the universe as a complex, energetic and stunningly beautiful place has not been arrived at without much controversy. Over the years, the conduct of astronomers in dispute with one another has often been bizarre, and sometimes hilarious.

Occasionally, their falling-out has reached monumental proportions. In this entertaining and informative talk, Fred Watson presents examples of astronomers behaving badly over the last two centuries or so.

WHAT'S HAPPENING TO GRAVITY?

We all take gravity very much for granted as the mysterious force that sticks us onto the Earth and stops us flying off into space. In fact, we owe gravity much more than that, for we now know that it has been the single most important force in shaping the universe. Our understanding of gravity has gone through two quantum leaps, with Newton's principia in 1687, and Einstein's general theory of relativity in 1915. But today there is another revolution taking place. Physicists all over the world are probing gravity at the quantum level, while astronomers are recognising that there is something more than just irresistible attraction going on out there in the universe. Join Fred Watson as he explores these themes and more in this entertaining and fully-illustrated talk.

STARGAZER - THE PAST, PRESENT AND FUTURE OF THE TELESCOPE

The telescope is literally the world's most far-reaching invention. It is a time machine, allowing us to look billions of years into the past for answers to some of our most profound questions. In its 400-year history, it has progressed from a crudely fashioned tube holding a couple of spectacle lenses to colossal structures housed in space-age cathedrals - and, increasingly, to sophisticated machines surveying the universe from space. In this entertaining and fully-illustrated talk, Fred Watson relates the story of telescopes, from their earliest days to today's complex machines, and give a sneak-peek at future telescopes - some of them only yet imagined. He also looks at the way telescopes have changed our view of the universe, and what astronomers hope to learn with them in future.

SPAGHETTI ASTRONOMY - REVEALING THE UNIVERSE WITH OPTICAL FIBRES

Over the past few decades, our knowledge of the Universe has been transformed by the advent of new technologies, ranging from spacecraft exploring the Solar System to giant telescopes sensing invisible radiation from the stars. An area in which Australia has become a world leader is in the use of fibre optics to survey the vital statistics of large numbers of celestial objects. This has given us our best understanding to date of the geography of the local Universe, and promises to reveal such secrets as the nature of the mysterious Dark Energy that permeates the Cosmos. New developments in this field have resulted in an Australian-German alliance that will exploit these pioneering technologies to the scientific benefit of both communities. In this entertaining and fully-illustrated talk, Fred Watson explains the exciting prospects ahead.

ASTRONOMY WITH ATTITUDE

The night sky has had a profound influence on human thought across all the cultures of the world. It has inspired a rich and varied folklore that attempts to sum up human attitudes to the sky and life on earth. Even more inspiring, however, is the picture of the awesome universe that modern science is providing. With our growing understanding of the origin of the universe, the planets and ourselves - and with the search for life beyond earth progressing rapidly - we are undergoing a revolution in knowledge that is nothing short of astonishing. What should our attitude to that be? Join Fred Watson of the anglo-australian observatory, as he explores these topics with stunning celestial images and entertaining inside information about our growing awareness of the cosmos.

TIMEWARP

Our deepest understanding of the beautiful Universe we live in comes from Einstein's theories of relativity, which he formulated a century ago. What Einstein probably didn't realise is that as well as describing the Universe, his theories also allow for time travel under certain circumstances. In this entertaining and fully illustrated talk, astronomer Fred Watson explains this 'Timewarp' in the down-to-Earth language that has become his trademark on ABC radio. If you thought relativity was something you could never understand, think again! This talk is for you!

BEYOND SPACE-TIME – REWRITING THE GEOMETRY OF THE UNIVERSE

Ninety-two years after its formulation, Einstein's general theory of relativity remains the best tool we have to describe the structure and evolution of the universe. It has passed all tests with flying colours, and the world's astrophysicists use it daily in studies as diverse as gravitational lensing and black holes.

Relativity's one stumbling block is its incompatibility with the quantum world, and this has led to the emergence of new "theories of everything" to reconcile our understanding of events on the largest and smallest scales. Intriguingly, the most promising of them - string theory and brane theory - are, like relativity itself, essentially geometrical. They suggest that we may be on the brink of discovering a multi-dimensional universe with characteristics very different from those of conventional space-time.

In this entertaining and stunningly illustrated talk, Fred Watson explores these ideas from an astronomer's perspective, and asks just where all this leaves Pythagoras' theorem...

FROM THE PERUVIAN DESERT TO THE UNIVERSE

An astonishing pre-Inca site in coastal northern Peru has recently been shown to be a solar observatory of epic proportions. The thirteen towers of Chankillo were visited for the first time by any Australian scientific group in November 2007, in collaboration between Fred Watson and the Peruvian archaeologist leading the investigation of the site. Apart from the sheer spectacle of the observatory, some new findings about the 2300 year old site resulted from the visit, revealing amazing insights and ingenuity on the part of the people who built it.

In this entertaining and fully-illustrated talk, Fred recounts the details of the visit, explains why Chankillo represents such a major finding in Astro-archaeology, and links the lives and beliefs of its builders with our modern understanding of the universe.

BANGERS AND MASH - POSITIVELY GLOWING WITH EXCITEMENT (SUITABLE FOR A NON-SPECIALIST AUDIENCE.)

Clouds of hydrogen in space are usually called nebulae, due to their misty (or 'nebulous') appearance. Surprisingly, they are a bit like human beings - they glow pink when they get excited. While the mechanism for this is rather different in the two cases, the flushed appearance of nebulae gives astronomers an easy way of spotting them. Just look for things that glow pink.

Back in 1997, scientists at the UK Schmidt Telescope in north-western NSW began a successful six-year search for pink clouds of gas. Among the interesting objects that came to light were 'bangers' (the remnants of exploding stars) and MASH (objects in the Macquarie Uni/Anglo-Australian Observatory/Strasbourg H-alpha planetary nebula catalogue). Studying these objects in detail helps astronomers understand the processes that take place at the end of a star's life, and can give us insights into what will eventually happen to our own Sun.

In this entertaining and fully-illustrated talk, Fred Watson explains how 'bangers and MASH' fit into the grand scheme of the Universe, how the search for them was conducted, and what the results are telling us.

MORE THAN A BIG WHITE DOME - THE PAST, PRESENT AND FUTURE OF THE AAO

When, in October 1974, Prince Charles launched the 3.9-metre Anglo-Australian Telescope (AAT) with his classic one-liner "I declare this aperture open", few could have imagined the illustrious career that would be carved out by this iconic bi-national instrument. From the outset, the telescope made an impact in the world of astronomy by virtue of its computer control system (the first to be used on a large telescope) and the enthusiasm and dedication of its staff. Today, it is still clever instrumentation and clever people that keep the AAT at the cutting edge of astronomy, despite the advent of telescopes with mirrors twice as big.

In this talk, Fred Watson looks at the history and achievements of the AAT, together with those of its smaller sibling, the 1.2-metre UK Schmidt Telescope, and asks what lies ahead for the AAO in a new era of Australian-only operation.

SPACEFARERS OF THE NEW MILLENNIUM

Over the past few years, robotic spacecraft from earth have made ever deeper forays in the field of planetary exploration. We now have unprecedented insight into the geological history of Mars, and astonishing new surveys of the bizarre moons of Saturn. Moreover, we stand on the brink of exciting new discoveries from mercury, Venus, Mars and, in a few years' time, Pluto. What is driving this feverish activity to understand the nature of the solar system? Using the latest amazing images from Mars and Saturn, Fred Watson spells out the motivation for these investigations. He also looks forward to the next phase of crewed spaceflight to the moon and beyond.

AUSTRALIANS VS. THE GALAXY – RAVE, GALAH AND BEYOND

The history and geography of our Milky Way Galaxy were poorly understood until the 1970s, when new large telescopes were built in the southern hemisphere. Even then, our understanding was limited to what could be gleaned from imaging surveys of the southern sky, such as those carried out by the AAO's UK Schmidt Telescope. But when pioneering experiments with fibre optics were conducted in Australia in the 1980s, the way was open for a new era in spectroscopic studies of stars by the hundreds of thousand.

It took more than a decade for this technology to mature, but we are now seeing the fruits of these efforts, with the completion of the RAVE survey of half a million stars, and the start of the new GALAH survey with the Anglo-Australian Telescope. In this entertaining and fully illustrated talk, Fred Watson explains the significance of these astronomical mega-surveys, describes some of the results from them, and looks to the future of Galactic astronomy in Australia.

JAMES GREGORY - SCOTLAND'S ISAAC NEWTON?

You might be forgiven for saying 'Who?', for while James Gregory (1638-1675) is remembered among astronomers as the inventor of the Gregorian telescope, he is little known outside scientific and historical circles. Yet he made substantial contributions to optics, coming within a whisker of building the first successful reflecting telescope, and accidentally discovering the device we now call the diffraction grating. Moreover, his work in mathematics was among the most original and far reaching of its time.

Why, then, is Gregory not a household name? His career culminated in professorships at St Andrews and Edinburgh, which apparently failed to live up to his expectations, but there are other reasons for his relative obscurity. The 2015 International Year of Light presents the perfect opportunity to investigate what went wrong with Gregory's career, and to explore his optical legacy. In this entertaining and fully-illustrated talk, astronomer and self-confessed Gregory enthusiast Fred Watson lifts the veil on this unsung hero of the seventeenth century.