PRIME FOCUS

MAS SOCIETY JOURNAL

macarthur astronomical society

Feb 2012

volume 17 issue 2

Lunar eclipse - December 2011. ImageCredit: Borislav Muratovic

From the Editor's Desk

Welcome to the February 2012 edition of Prime Focus - “volume 17, edition 2”.

Prime Focus is the Society's monthly electronic journal, containing information about Society affairs and on the subjects of astronomy and space exploration from both members and external contributors.

We are constantly seeking articles about your experiences as an amateur astronomer and member of MAS, on any astronomy-related topic about which you hold a particular interest. Please submit any articles to the Editor at **editor@macastro.org.au** at any time. Original type-written material on A4 paper may also be submitted as they are able to be scanned. Please ensure that the quality of type is good.

Both “print” (large high-quality PDF) and “screen” (small low-quality PDF) electronic versions of this February edition are now available at the "*Members/Prime Focus/2012*" menu link on our website at:

http://www.macastro.org.au for members to download at their leisure.

Other astronomical societies, as well as industry-related vendors, may request a copy of this edition of Prime Focus in electronic form by sending an email to **secretary@macastro.org.au**.

If amateur astronomy-related vendors would like to advertise in Prime Focus please send an email to the Secretary with your details, and we will endeavour to come back to you with a suitable plan.

Please enjoy this February edition - our second for the new-look year 2012.

Clear Skies!
Chris Malikoff

Contents

Sunset from Stargard - ImageCredit: James Scott

Then-President outside "m a g n i t u d e" - 2010 - ImageCredit: Chris Malikoff

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Member profile - Chris Malikoff

As a 10 year old, I used to sit in the back seat of my folks car on the way back home from weekends at our property just outside of Mudgee NSW and stare up at the night sky through the back window until my neck cramped. Even then, I was already an avid fan of everything "space". My interest had been triggered by watching Neil Armstrong, Buzz Aldrin and Michael Collins carry out what I recognised, even then, as the most significant forward step in human history. I remember being disappointed by most of my fellow school kids around me on that day, who thought it was "OK", but really failed to become excited and recognise it for what it was. It was privilege afforded to our generation - to actually witness man's first visit to another planetary body. This wasn't a once in a lifetime event - it was unique in all of history.

My younger brother Steven and I spent many a day in our back yard sending model Saturn 5 water rockets to the moon. We built every plastic model in the Revell catalogue that had anything to do with space travel. My father worked for IBM, and brought home consoles and switch banks from old main frame computers for us to play with. We dreamed of being in mission control making our own history. I remember nearly killing the both of us by plugging in one of the 48 volt DC panels into a 240v socket to see what would happen. I burned a hole in the carpet a foot wide as it exploded. I put it down to being an intrepid explorer, which my father thankfully recognised. All good and well - but my rear end still smarts, now, forty years later. I'm glad he never found out how many fire crackers it took to ignite our model collection behind the bushes in the back yard in the name of ballistic science.

Inevitably, my passion for space travel translated into an interest in astronomy later in life. I can't say that I'm particularly involved in the pure science of it, as such, but more in trying to record its sheer majesty. This is not to say that the science doesn't interest me - it certainly does. I'll just leave it to others while I aim my refractors upwards and attempt to capture what I can on camera. Again it's fantastic to be around during an age when amateur astrophotographers like myself have access to reasonably priced equipment that becomes more advanced day by day.

I joined MAS during the middle of 2006. Through it I've met and enjoyed the fellowship of great friends who share a common interest. There is an incredibly diverse range of experience and knowledge within the society, making it a constant source of inspiration to me. As current VP and editor of Prime Focus, I feel absolutely privileged to be involved in this little oasis here in Macarthur.

Chris

president's report

TREVOR RHODES

The time has come, the Walrus said, to talk of many things:

Of clouds--and scopes--and Registax--
Of eyepieces--and primary mirror springs--
And whether Pluto is a planet or not--
And other astronomical things."

Well, maybe not, but 2012 is starting to look like a good year.

We have set dates for public nights, Sat. 28th April, Sat. 28th July and Sat. 20th October. There are a couple of other public outreach events in the works with dates still to be set. So, my dear MAS volunteers, bone up on your astro-knowledge for it will come in useful in the near future. If you are willing to help out on these nights, please let me know and I'll keep you informed as we get nearer to the events.

The next Forest weekend will be 24th, 25th and 26th of February. Remember, if you wish to stay for the third night, you will need to inform Tony Law beforehand. Stargard will be on the 17th March and by then, if we're lucky, all this moisture may have abated. We live in hope.

We have been contacted by two other Astro Societies about visiting them on one of their viewing nights. We will be finalising dates for these visits shortly, and when we have, we will be asking for a list of names of those wishing to go along.

All in all, 2012 is looking to be a busy year.

Looking forward to doin' it with you in the dark...

Trevor

A reminder that current single issues of Prime Focus will be available for sale in hard-copy paper form, in limited numbers, at $6 each on MAS Forum evenings. Back-issues are also available until sold out.

secretary's column

ROGER POWELL

I am determined not to mention clouds in this month's column...

Our meeting this month will again be held in the lecture theatre in UWS Building 30. Because of our unfamiliarity with this temporary meeting location, it is believed that more members attended the last two meetings than actually signed the attendance register. Maybe it was the cloudy conditions. The book will be at the back, near the door. If you were at the Nov. or Jan. meetings in Building 30, you may retrospectively sign because we like to keep accurate records of how many members and visitors come to the meetings.

A new member recently raised the question of what can and what cannot be posted on the MAS Web Forum. The answer is that the committee have never placed any restrictions on what topics can be posted. I hope it never does. Of course, disrespect towards other members will not be tolerated but beyond that the Web Forum is a resource that is placed there for the members to use as they see fit and to encourage sensible discussion. Traditionally, topics have been astronomy related ñ discoveries, clouds, web-links, YouTube clips etc. - but no restriction has ever been placed on what can be discussed. Above all, the Forum is the best place for members to ask basic or complex questions, whether about telescope operations or about black hole singularities, it does not matter if it stimulates conversation.

2011-12 memberships expire on 29th February and the new MAS financial year begins on 1st March. Many members have already renewed their membership - thank you - and it is our aspiration to achieve a 100% renewal rate this year. Hopefully, most of us who have not yet renewed will be seeing Treasurer Tony Law at the next meeting. Please also return the Membership Application/Renewal Form, the purpose of which is to confirm all contact details and seek your responses to a few simple questions.

The committee is still evaluating the proposition of building an observatory in the Dharawal National Park and it is apparent that there will be many obstacles in our path, many hurdles to jump over. Identifying a suitable site; getting the cooperation of all stakeholders; getting planning approval; obtaining government grants; and assessing if the clouds will ever go away; will all be very difficult tasks. However, it is the dream of astronomical societies like ours to own their own observatory and - as one politician said a few short years back when he became Premier of NSW - the committee has resolved to give it a “red hot go”.

One thing that would be very apparent to every member is that the cost of such a dream is well beyond the Society's own current financial means and that we will have to beg or borrow to achieve it. Your committee believes that it will be mainly through seeking and obtaining considerable state and federal government grants that we will succeed. However, to obtain such grants (or even if we were to seek a bank loan), we will almost certainly need to prove to any potential benefactors that we are also capable of raising a portion of the required revenue ourselves.

We currently have a modest fixed term deposit and a small working bank account with the Commonwealth Bank. Maintaining this money and adding to it is going to be absolutely crucial to this project, if it is to proceed. Whilst it may be very tempting to spend some of it on exciting new items of equipment now, my long-term view is that it is critical to achieve continuous positive financial growth if we are to achieve the aims that the committee has set out.

Members may not be aware that since stepping down as President ten months ago, John Rombi has retained responsibility for guest speaker liaison. What a fantastic job he has done! This year is already fully booked out and John is already twisting arms to start filling spots in 2013. Have you checked the guest speaker page on the website recently?

Another unsung hero who deserves our applause is Stewart Grainger, who has tackled the daunting task of managing the purchase, storage and marketing of all those little items you see on the website and on his table at monthly meetings. It is a thankless but very valuable task that Stewart has carried out for the last three or four years and I hope he can maintain his momentum for a good while longer yet.

Members are reminded that tea, coffee and biscuits are provided after each Macarthur Astronomy Forum. The price for this is $2.00 in the jar. This is an “honour” system and members are respectfully asked to put their money in the jar before pouring their drink.

That's all for now and I didn't even mention the six letter plurality beginning with ìcî and the absolutely atrocious weather that is driving amateur astronomers barmy for the last few months. I am hearing reports of spider webs on telescope mounts and thick layers of dust on telescopes. The rumour is that our most experienced members will be sent on a refresher course to learn how to use their telescopes again, whilst John will be inviting the head of the Bureau of Meteorology to front up to one of our meetings....

Schedule Planner

February 2012

20/2/2012
Macarthur Astro Forum

24/1/2012
The Forest

25/2/2012
The Forest

26/2/2012
The Forest

"In a Flat Spin"

Part 2

THERMODYNAMICS: CAN YOU REALLY GET SOMETHING FOR NOTHING?

A SERIES OF ARTICLES BY DAVY JONES

It is astonishing that the search for a perpetual motion machine which worked has apparently continued into the present era. Lack of empirical or physical evidence in support of the fanciful idea has in fact been evident for centuries. Consider this: if such a machine had been possible - and a successful apparatus had been built - it would have rapidly become - 'an eighth wonder of the world" and, barring wear and tear, would have certainly stood the test of time for all to witness. It is fair to say that simple ignorance of the laws of physics accounted for many hundreds of years of wasted effort. Whilst some of the past attempts at producing working machines were quite original and ingenious in design - many subsequent machines were mere re-inventions of earlier failures.

Natural human optimism may have been the motive behind the stubborn persistence of this lost cause. Without doubt, an element of fraud for personal gain also lay behind much of the falsely proclaimed progress in this area. The laws of physics that assured failure and barred the fallacy of perpetual motion becoming reality have in fact been established for some considerable time. These laws - we know today as: "The Laws of Thermodynamics" - loosely translated as the laws of heat movement.

Nicolas Léonard Sadi Carnot (1796-1832) - a French physicist and military engineer, is recognised as the founder of these laws in their most basic form. Naturally, as with most scientific development, Carnot did not achieve his outcomes single-handedly. It would take many years and the collective efforts of a few good people before the set of Laws of Thermodynamics were presented in the mathematical form we have today. Interestingly, Carnot's work represents a prime example of the formalization of the craftsman's or artisan's knowledge moving from, in Carnot's case, an engineer's practical view into the more esoteric mathematical world of science and physics. Too often we forget the importance of the part played by the nameless artisan, the common man - even in astronomy - which if one seriously considers, probably developed as the only sure means of navigation by the earliest mariners and the like as they began to travel around our world.

On taking permanent leave of absence from the French army around 1818, Carnot, began investigating the processes concerned with improving the efficiency of steam engines. In 1824, he illustrated his analysis of what he described as - the perfect engine - naturally enough, christened the Carnot Engine. Today we are perhaps more familiar with this perfect engine as - the steam reciprocating engine. Carnot had realised that the steam engine as it existed was not achieving anywhere near its full potential. His design ensured that all the available energy supply being produced was employed. In the process of this development, he discovered that heat couldn't be conveyed from a colder to a warmer entity, and jointly, the efficiency of an engine relies specifically on the amount of heat (energy) the machine is capable of using.

We today might consider such a bland statement to be almost primitive in its obviousness; we who now

employ such advanced technology in our normal everyday transport. However, reflect on this, before we smugly travel too far down the road of self-aggrandizement. Even today, modern petrol engines are estimated to have a maximum thermal efficiency of approximately 25% to 30%. Most of the heat energy released from the burned fuel is rejected - lost - dissipated - without that heat being converted into any practical effort. Likewise, even the much vaunted diesel engine is similarly inefficient. Whilst diesel is an improvement on petrol - the turbo-charged (super-duper) all bells and whistles unit - can only achieve about 50% of its potential efficiency! There is one silver-lining to all this human inefficiency; our attempts to release energy using nuclear reactions is quite plainly pathetic. Alongside mother nature the human race fails miserably with our best attempts at playing with nuclear energy - releasing only a fraction of a percent of the potential energy available. Just imagine the BIG BANG we could make if only we knew how! On second thoughts...

Anyway - I digress; in spite of their importance, Carnot's achievements were not recognised in his lifetime, and received very limited acknowledgement.

"All science is either physics or stamp collecting"

E. Rutherford (1871-1937)

His discoveries and publications were typically ignored. Nicolas Carnot died of cholera, aged just 36 years, on 24th August 1832. It would be another twenty-five years before the term - thermodynamics - would be coined. In 1850, William Thompson aka Lord Kelvin (1824-1907) confirmed some of Carnot's theories; additions to those theories by Thompson and others eventually led to the advance of the second law of thermodynamics.

Other more familiar names connected to the ultimate formulation of the laws of thermodynamics include Rudolf Clausius in Germany, Julius Robert von Mayer, James Prescott Joule, and Benoît Paul Émile Clapeyron. Max Planck's earliest work was on thermodynamics; in 1891 he produced papers on entropy, on thermoelectricity and on the theory of dilute solutions. Regrettably for Planck, he was to find that the central work on entropy had already been completed, by a man described as - 'perhaps the most brilliant person most people never heard of' - Josiah Willard Gibbs (1839-1903).

Gibbs, a reclusive character, was described by Albert Einstein as 'the greatest mind in American history'. Gibbs's extensive work on thermodynamics would open the way for many of Einstein's future discoveries. Between 1876 and 1878, Gibbs worked on the principles of thermodynamics - applying them to the intricate processes concerned in chemical reactions. His work culminated with the publication of a paper entitled: On the Equilibrium of Heterogeneous Substances. His work clarified the thermodynamic principles of nearly all states of matter. Specifically, his work included: gases - mixtures - surfaces - solids - phase changes - chemical reactions - electrochemical cells - sedimentation and osmosis. Gibbs clearly demonstrated that thermodynamics didn't just relate to the large-scale world - thermodynamics was also present at the atomic level of chemical reactions.

The significance of his discoveries was not initially acknowledged, particularly in his native USA. Gibbs's written work was often difficult to follow due to his use of a personal form of notation, which others found difficult if not impossible to comprehend. When his publications were read, they were thought to be too mathematically complex for many chemists - yet too scientific for many mathematicians. It wasn't until 1901, that Gibbs was awarded the Copley Medal of the British Royal Society - the most esteemed international science award at that time.

In concluding - not being one to reinvent the wheel - I offer this summary by the chemist P. W. Atkins of the Laws of Thermodynamics. 'There are four Laws. The third of them, the Second Law, was recognised first; the first, the Zeroth Law, was formulated last; the First Law was second; the Third Law might not even be a law in the same sense as the others.' Bryson pp.107.

Bryson continues thus… the Second Law states that a little energy is always wasted. You can't have a perpetual motion device, because no matter how efficient, it will always lose energy and eventually run down. The First Law says that you can't create energy and the Third that you can't reduce temperatures to absolute zero; there will always be some residual warmth.

Just a small clarification on the Zeroth Law; it states that if two systems are at the same time in thermal equilibrium with a third system, they are in thermal equilibrium with each other. Quite simply put - the systems will eventually all become the same (lower) temperature. Anyone who has left their cup of tea outside, sitting on a cold step, will now understand why it cools. It's the Law!

To be continued...

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Image Credit: Keck Observatory

2013 Hawaiian Sojourn

MAS Field Trip

Tony Law

Another reminder to MAS members - we are arranging a trip to the 'Big Island" of Hawaii in 2013.

Planned itinerary is for 5 nights viewing on Mauna Kea, Hawaii (Hilo) and four days on Oahu (Honolulu). Hilo is the start point for visiting the major telescopes on the summit and observing from the Onikuza Visitors centre. A trip to the Kilauea Volcano is also envisaged.

On Oahu we will stay in Waikiki and visit Pearl Harbor, the Polynesian cultural centre, Pipeline (surf beach), etc ..... However itinerary here is flexible, some may wish to go elsewhere from here, we will discuss closer to the time.

The anticipated total cost will be around $1,250.00 for airfares, $1,000 for accommodation and $500.00 for food etc. Another couple of hundred for transport so about $3,000.00 in total. Add a couple of hundred for incidental tours. We'll provide more details much closer to the time.

To help MAS Members save for this trip, we have set up a special bank account. You may pay in whatever and whenever you wish by direct debit or by cash over the counter. You must ensure that you include your name in the reference when you make the deposit so that it can be refunded if required. This is a non-interest-bearing account.

We look forward to hearing from all interested.

Call Tony on 0419 215199 if you have any questions or would like to know the bank account details.

Planned Itinerary

Depart: Sydney Tuesday 4th September 18.00

Arrive: Honolulu Tuesday 4th September 07.45 - we cross the dateline!

Depart: Honolulu Tuesday 4th September 11.48

Arrive: Hilo Tuesday 4th September 12.50

Accommodation: see http://www.seasidehotelshawaii.com/HotelHilo.aspx

Nights of 5-9th on Mauna Kea. See weather forecasts: http://mkwc.ifa.hawaii.edu/forecast/mko/

Thursday 6th September – Special visit to Gemini North and one of IRTF, CFHT, or the UH 2.2 meter, plus the Keck visitors observation room.

Saturday 8th and Sunday 9th September – drive Mauna Kea summit in convoy for night time viewing

Bus trip to Volcanoes National Park is 12 hours and costs $179.00 - probably not advisable as we want to do MK each night! By Helicopter 1hour $230.00. See http://www.hawaiiactive.com/activities/bigisland-paradise-helicopter.html

Depart: Hilo Monday 10th September 13.18

Arrive: Honolulu Monday 10th September 12.07

Accom: http://www.outrigger.com/hotels-resorts/hawaiian-islands/oahu-waikiki/ohana-waikiki-east#tab-prop-detail-rooms

Tuesday 11th: Pearl Harbour, Arizona, Missouri etc $70.00

Wednesday 12th: Polynesian Cultural Centre, tour, dinner and show $150.00

Thursday 13th: Shopping/sightseeing in Honolulu/Waikiki

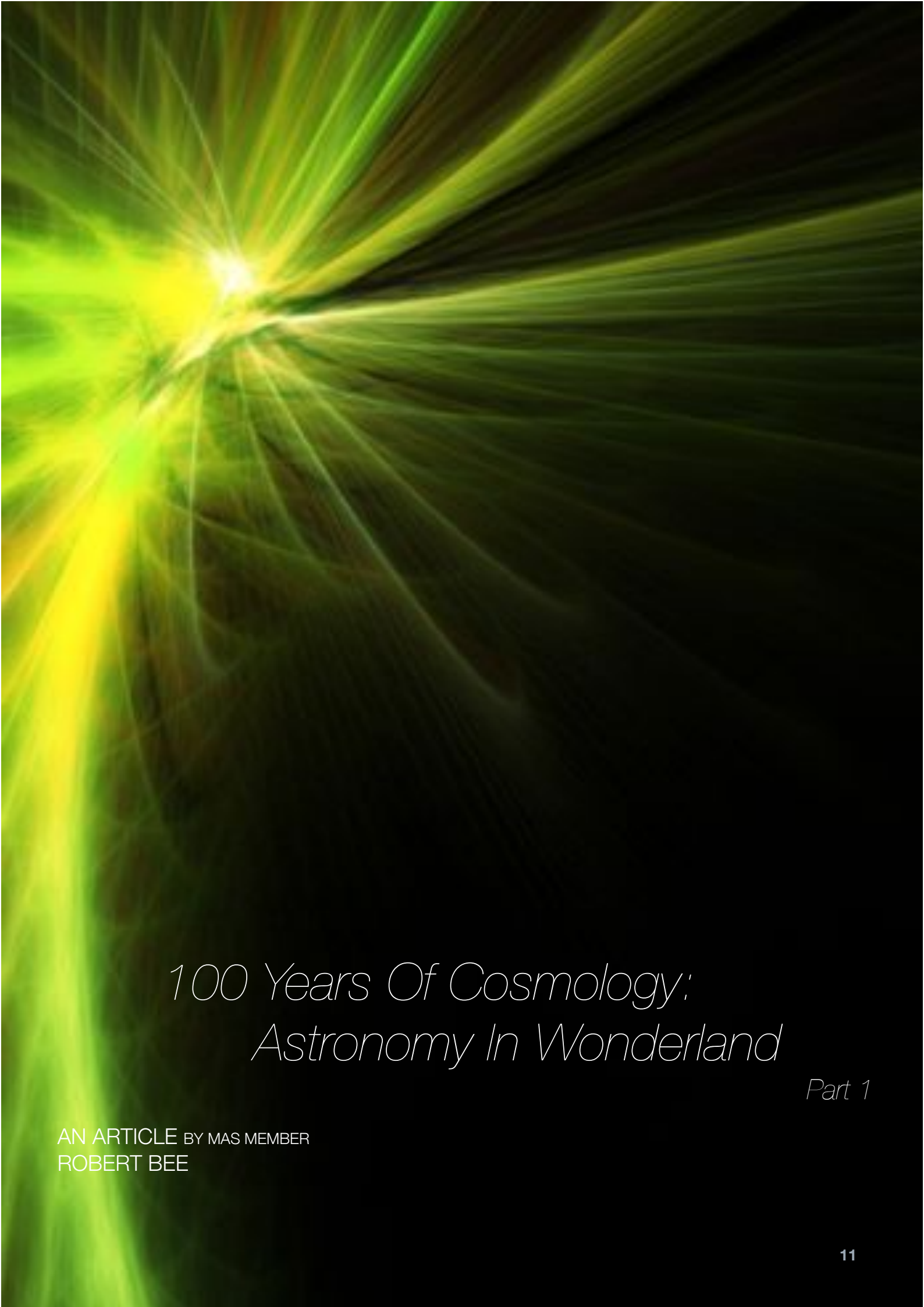
Depart: Honolulu Friday 14th September 12.45 (or your own itinerary from here)

Arrive: Sydney Saturday 15th September 19.30 -dateline crossed!

Tentative total:

Flights	$ 1200.00
Accom.	$ 500.00 based on twin share
Heli tour	$ 230.00 optional
Pearl Hbr.	$ 70.00 optional
PCC	$ 150.00 optional
Meals	$ 400.00
Veh Hire Hilo	$ 100.00
Total Cost	**$2650.00 excluding discretionary shopping!!!**

In order for MAS Members to save for this trip we have set up a special bank account. You may pay in whatever and whenever you wish by direct debit or by cash over the counter. Account is at the Commonwealth Bank, name is Macarthur Astronomical Society BSB 062656 a/c no. 10243417. You must ensure that you include your name in the reference when you make the deposit. Please advise me when you make your initial deposit so that we can start a spreadsheet with all those making payments.



100 Years Of Cosmology: Astronomy In Wonderland

Part 1

AN ARTICLE BY MAS MEMBER
ROBERT BEE

100 YEARS IN COSMOLOGY

ASTRONOMY IN WONDERLAND - CURIOUSER AND CURIOUSER

(By Bob Bee)

INTRODUCTION:

This series of articles explains how the last 100 years of astronomical investigations have altered our understanding of the universe from a static, unchanging and ageless one to a dynamic, expanding and absolutely weird one that would make even Lewis Carroll's head spin. In that relatively short period, the cosmos left its comfortable but naïvely simple form and moved towards a universe that progressively became 'curiouser and curiouser'.

It is an evolving story, very much like a mystery novel as clues are progressively discovered by the detective and, as each new clue is revealed, the plot thickens. Red herrings abound.

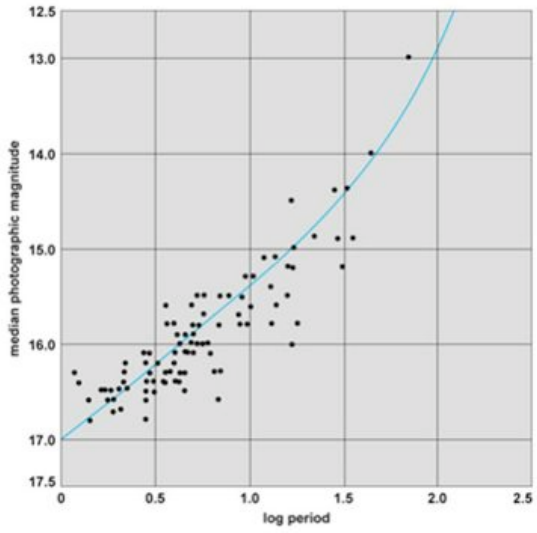
Sadly, for reasons of space constraints, it will have to be the Readers Digest condensed version, with much fine detail and many contributing players omitted. Hopefully, you will still grasp an essence of the story and the science it contains. Through it all there is a single thread – what is the ultimate fate of the universe?

We start in the early 1900s.

At this time, before the 1920s, astronomers, even with the benefit of giant telescopes like the Yerkes 40 inch refractor – the largest in the world – and the Hale 60 inch reflector at Mount Wilson, still thought that those wispy 'spiral nebulae' were all gassy clouds within our own Milky Way galaxy. In fact, the cosmological model of the time was that the Milky Way and all the objects visible within it comprised the entire universe.

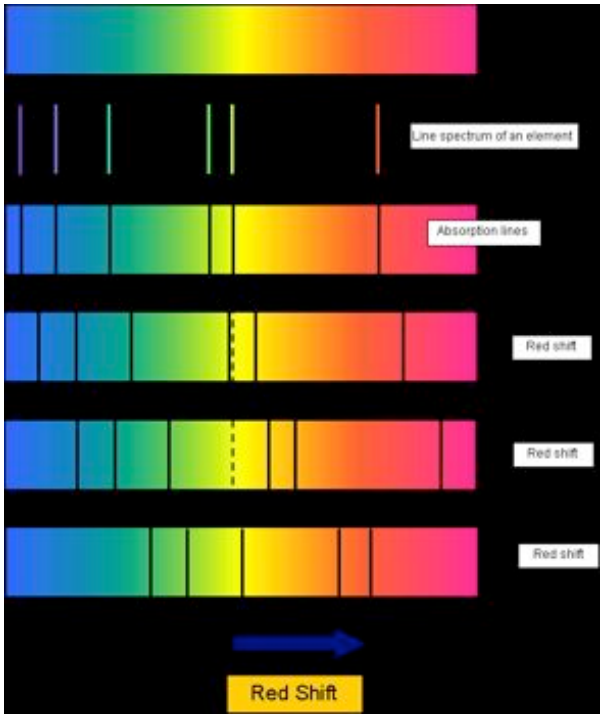
It was also thought that the universe was static, all the stars and nebulae (including those mysterious spiral nebulae) were fixed in space, unmoving. The Universe always was and always will be as they saw it. No beginning, no end. That blissful state of cosmological 'ignorance' is where our story begins.

In 1908 Henrietta Leavitt, working for the Harvard Observatory, laboriously sifted through photographic plates of the Large Magellanic Cloud (taken by its observatory in Peru) and identified Cepheid Variable stars. She discovered the principle that the brighter Cepheids had the longer periods and was able to translate this to a means of measuring the distances to very distant objects by measuring the Cepheid's period and observing its apparent brightness. This was to be of vital importance for what was to come. A copy of Leavitt's history making plot of Cepheid variables in the LMC is shown below, with the trending very obvious.



In 1912, Vesto Slipher (from Lowell Observatory) took many spectra (about 41) of the so-called spiral nebulae which seemed to populate the Milky Way.

Slipher was studying the spiral nebulae as part of his work for Percival Lowell who believed passionately in life on Mars. It was thought these spiral nebulae may be solar systems in formation so to take their spectra was a logical extension of his work. To his surprise, he found that in most of them the recognisable spectral lines (absorption lines from elements in the star light) were further towards the red end of the spectra than their counterparts in the laboratory. Examples of this concept are shown in the image below.



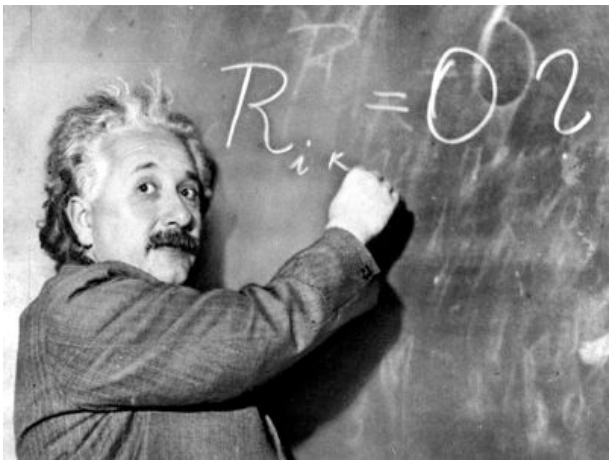
This is a type of Doppler Shift called 'red shift,' a phenomenon we are now well aware of.

The formula for Red shift is: $z = (\lambda_{obser}/\lambda_{emit}) - 1 = (\lambda_{obser} - \lambda_{emit})/\lambda_{emit}$

(where λ (lambda) is the wavelength of the light)

In fact, measurement of the red shift gave a direct value of the speed (velocity) the object was moving away from us. (In the case of the Andromeda 'nebula' and a small number of others, it was in fact a blue shift, giving the velocity with which they were moving towards us.) This told Slipher that the majority of these 'spiral nebulae' were moving away from us, but at that time, it was not understood why. He may have thought it was some property of the formation of a solar system. Slipher's study did not include an estimate of the nebulae's distances so he had no reason at that time to intuit that they were in fact outside our Milky Way. His data on the red shifts of these nebulae, however, were to be very valuable to others.

In 1917, Einstein published his now famous Theory of General Relativity which was ultimately a theory about gravity and its impact on space-time. He had been working on this momentous theory since the publishing of his ground breaking Special Theory of Relativity in 1905. He was working on it all the time Leavitt and Slipher were conducting their own research.



Einstein field equations (EFE) are a set of ten equations that define the basis of general relativity theory. Unfortunately, by the very nature of their tensor mathematics, they were horrendously complex and difficult to solve. Not for the faint hearted. One core equation is:

$G_{ab} = (8\pi G/c^4)T_{ab}$

(where G_{ab} is the Einstein tensor, c is the speed of light in a vacuum and G is the gravitational constant, which comes from Newton's law of gravity, and stress-energy tensor T_{ab}.)

His theory, when applied to the universe at large, could accommodate either an expanding or contracting universe, but significantly, not a static one. Now Einstein had been assured by contemporary astronomers that the universe was static. (Remember, Einstein was a physicist, not an astronomer.) So, although he thought it made his equations messier, tainting their much cherished elegance, he added an extra term with the Cosmological Constant in it, to make his model of the universe static. (Note: This only had any effect on large scales, not local relativity effects. Hence 'cosmological'.) This expanded the above field equation to:

$G_{ab} + \Lambda g_{ab} = (8\pi G/c^4)T_{ab}$. Λ (lambda) is the Cosmological Constant.

This Cosmological Constant would play a major role in future cosmology theories as we will see later, but not before encountering a few bumps along the road.

Sir Arthur Eddington.

A few years later after Einstein published his General Relativity Theory, (Sir) Arthur Stanley Eddington, a great English astronomer of his time, thought Slipher's red shifts might be a vital clue to a new cosmology based on General Relativity. Eddington, at the time, was one of the world's few astronomers having the mathematical skills to understand General Relativity. He was such a champion of the theory that he led an expedition to observe the solar eclipse on the 29th May 1919 and, by measuring the bending of the light from a star close to the Sun's edge, provided strong supporting evidence to the theory.

He included Slipher's red shifts in his 1923 textbook Mathematical Theory of General Relativity. By this act, Eddington was later shown to be a man of perception. Though we won't hear more of him in this article, Eddington's contribution to future cosmological debates, particularly with respect to the Cosmological Constant, is not to be underestimated.

END OF PART 1

In Part 2, we will look at the Friedman Models from solutions to the Einstein Field Equations, examining the concepts and consequences of the universe's critical density and density parameter, the huge impact on cosmology by Hubble's famous discovery, and the competing theories to explain the expanding universe – the Steady State Theory and the Big Bang. And the winner is…

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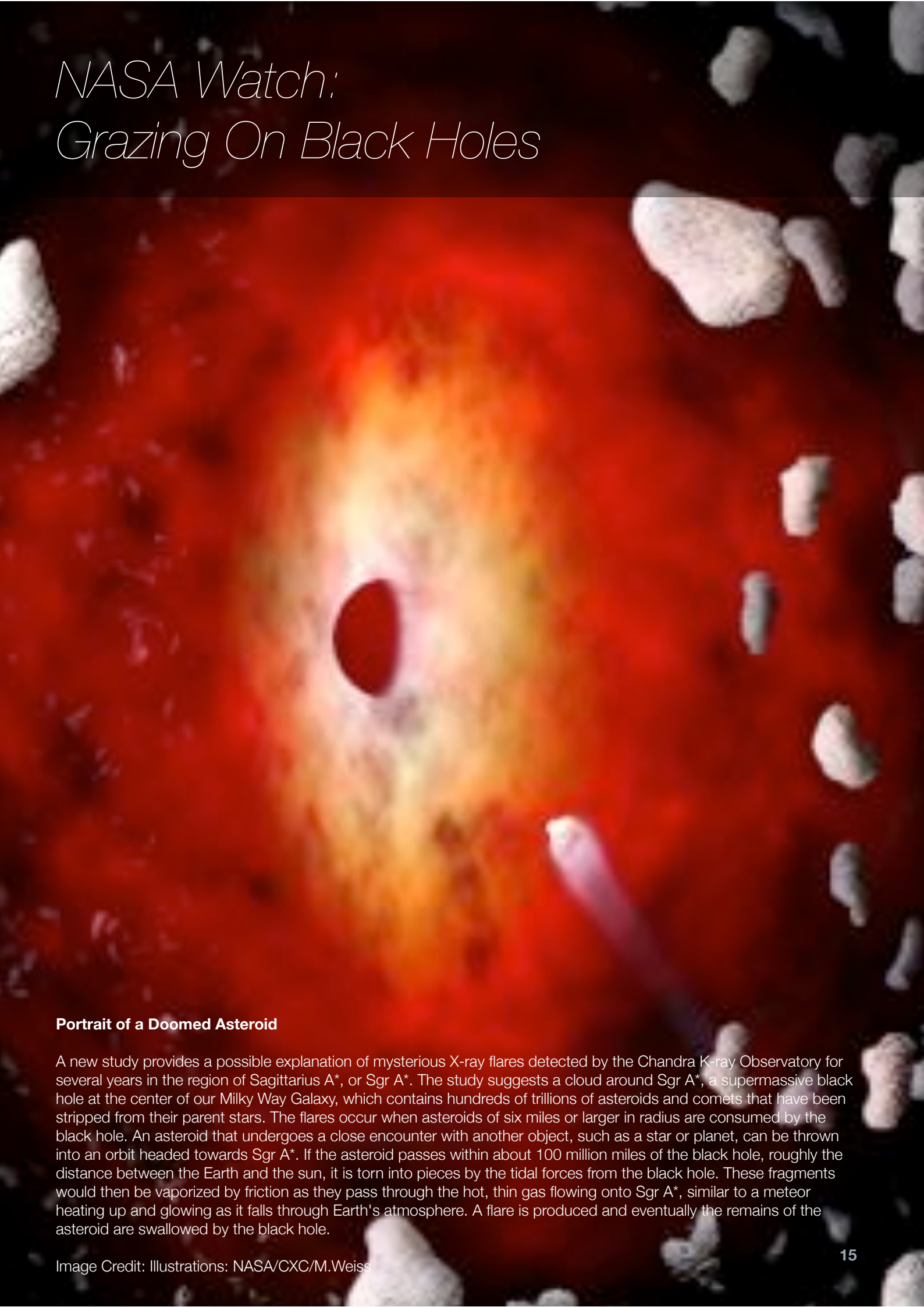
NASA Watch: Grazing On Black Holes



Portrait of a Doomed Asteroid

A new study provides a possible explanation of mysterious X-ray flares detected by the Chandra K-ray Observatory for several years in the region of Sagittarius A*, or Sgr A*. The study suggests a cloud around Sgr A*, a supermassive black hole at the center of our Milky Way Galaxy, which contains hundreds of trillions of asteroids and comets that have been stripped from their parent stars. The flares occur when asteroids of six miles or larger in radius are consumed by the black hole. An asteroid that undergoes a close encounter with another object, such as a star or planet, can be thrown into an orbit headed towards Sgr A*. If the asteroid passes within about 100 million miles of the black hole, roughly the distance between the Earth and the sun, it is torn into pieces by the tidal forces from the black hole. These fragments would then be vaporized by friction as they pass through the hot, thin gas flowing onto Sgr A*, similar to a meteor heating up and glowing as it falls through Earth's atmosphere. A flare is produced and eventually the remains of the asteroid are swallowed by the black hole.

Image Credit: Illustrations: NASA/CXC/M.Weiss

The giant black hole at the center of the Milky Way may be vaporizing and devouring asteroids, which could explain the frequent flares observed, according to astronomers using data from NASA's Chandra X-ray Observatory.

For several years Chandra has detected X-ray flares about once a day from the supermassive black hole known as Sagittarius A*, or "Sgr A*" for short. The flares last a few hours with brightness ranging from a few times to nearly one hundred times that of the black hole's regular output. The flares also have been seen in infrared data from ESO's Very Large Telescope in Chile.

"People have had doubts about whether asteroids could form at all in the harsh environment near a supermassive black hole," said Kastytis Zubovas of the University of Leicester in the United Kingdom, and lead author of the report appearing in the Monthly Notices of the Royal Astronomical Society. "It's exciting because our study suggests that a huge number of them are needed to produce these flares."

Zubovas and his colleagues suggest there is a cloud around Sgr A* containing trillions of asteroids and comets, stripped from their parent stars. Asteroids passing within about 100 million miles of the black hole, roughly the distance between the Earth and the sun, would be torn into pieces by the tidal forces from the black hole.

These fragments then would be vaporized by friction as they pass through the hot, thin gas flowing onto Sgr A*, similar to a meteor heating up and glowing as it falls through Earth's atmosphere. A flare is produced and the remains of the asteroid are swallowed eventually by the black hole.

"An asteroid's orbit can change if it ventures too close to a star or planet near Sgr A*," said co-author Sergei Nayakshin, also of the University of Leicester. "If it's thrown toward the black hole, it's doomed."

The authors estimate that it would take asteroids larger than about six miles in radius to generate the flares observed by Chandra. Meanwhile, Sgr A* also may be consuming smaller asteroids, but these would be difficult to spot because the flares they generate would be fainter.

These results reasonably agree with models estimating of how many asteroids are likely to be in this region, assuming that the number around stars near Earth is similar to the number surrounding stars near the center of the Milky Way.

"As a reality check, we worked out that a few trillion asteroids should have been removed by the black hole over the 10-billion-year lifetime of the galaxy," said co-author Sera Markoff of the University of Amsterdam in the Netherlands. "Only a small fraction of the total would have been consumed, so the supply of asteroids would hardly be depleted."

Planets thrown into orbits too close to Sgr A* also should be disrupted by tidal forces, although this would happen much less frequently than the disruption of asteroids, because planets are not as common. Such a scenario may have been responsible for a previous X-ray brightening of Sgr A* by about a factor of a million about a century ago. While this event happened many decades before X-ray telescopes existed, Chandra and other X-ray missions have seen evidence of an X-ray "light echo" reflecting off nearby clouds, providing a measure of the brightness and timing of the flare.

"This would be a sudden end to the planet's life, a much more dramatic fate than the planets in our solar system ever will experience," Zubovas said.

Very long observations of Sgr A* will be made with Chandra later in 2012 that will give valuable new information about the frequency and brightness of flares and should help to test the model proposed here to explain them. This work could improve understanding about the formation of asteroids and planets in the harsh environment of Sgr A*.

NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory controls Chandra's science and flight operations from Cambridge, Mass.

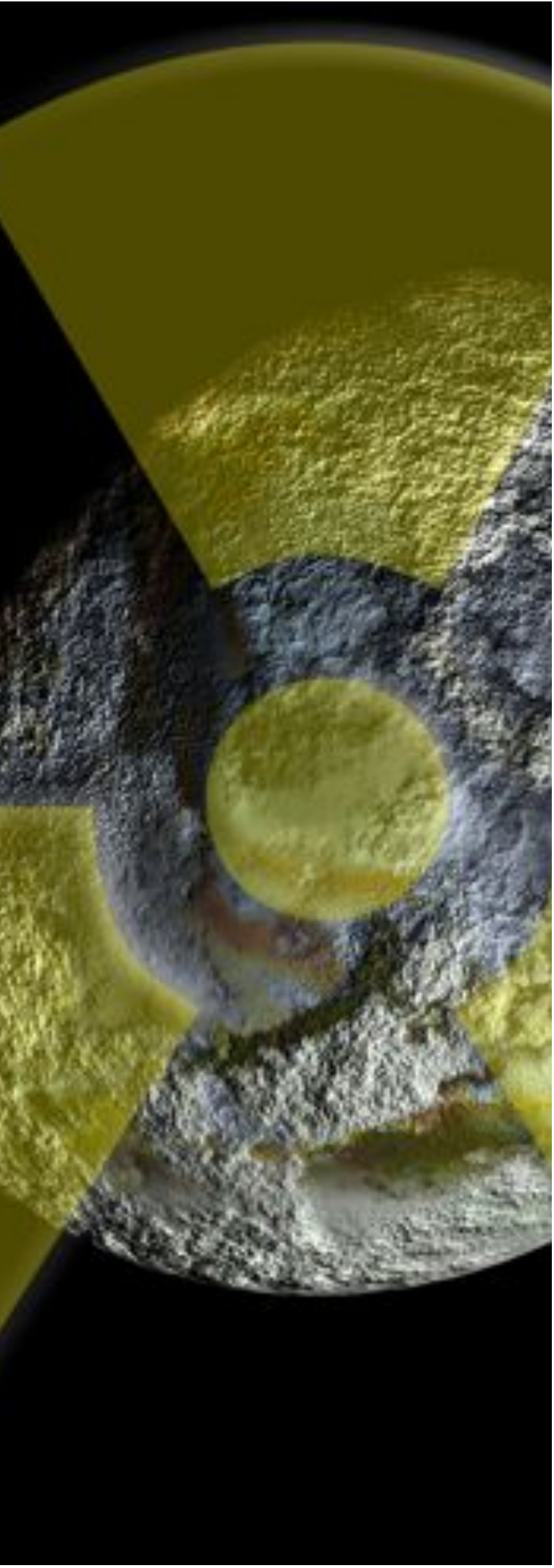
For Chandra images, multimedia and related materials, visit:

http://chandra.si.edu

For an additional interactive image, podcast, and video on the finding, visit:

http://www.nasa.gov/chandra

ImageCredit: NASA



"THREE WISHES FOR TOMORROW"

PART1

(A short story by Robert Bee)

The following story was published in ***Aurealis – Australian Fantasy & Science Fiction*** *Issue #27/28 in 2001.*

~~~

A north easterly teased the sails as John Billton stood at the ship's bow, staring at a single star nestled against Arcturus in the constellation of Bootes.

It was an unexceptional fourth magnitude star. About twelve light years away he remembered.

Still, he stared at it.

The bow lifted gently. Rainbow Warrior III slid into the trough and rose to meet the next wave. Billton's lean body moved to the deck's rhythm, his eyes never wavering from the star.

An ordinary star amongst ordinary stars.

And still he stared.

A sudden shiver swept over him, despite the balmy summer air. He was surprised to feel a warm tear rolling off his cheek to meet the bristles of his new beard. He wiped it away with a sigh.

His previous unshakeable certainty was giving way to human doubt. If Einstein and the astronomers are right, we'll have confirmation in twelve years, he thought.

And then...?

And then we'll know if John Billton was a planetary hero or the world's craziest megalomaniac.

***

"How long now?" Angus 'Crocodile' McWhirter spoke through painfully cracked lips.

"About five minutes less than the last time you asked." John Billton was feeling the cloying heat, and his tolerance of McWhirter's manner was approaching breaking point. Three weeks ago on Rainbow Warrior III, when they planned this quixotic escapade, they had been on the best of terms. Close, mutually respecting friends who shared a common aim and thought they knew each other's minds better than wives or lovers ever could.

But ten days of physical inactivity, concealed in a cramped, fouled, bug infested hole in the ground with only cold rations to eat and each other's company for entertainment had brought that relationship to a dramatic end.

"How long, I asked, damn you," McWhirter spat. He would have shouted, so hard that Billton would be blown against the sandy wall, but then they would have heard him. And that wouldn't do. Not yet.

"How...?"
~~~

"Sixteen minutes," Billton forestalled him. He stared at McWhirter. The sudden uncanny resemblance to John the Baptist caught him by surprise. Wild tangled hair, bushy beard, a large hooked and crooked nose, not quite bisecting his large piercing eyes. Everything except the wolf furs and locust sandwiches.

"Sixteen minutes," McWhirter repeated, not noticing Billton's fascinated gaze. "This bloody heat." He wiped a sweat soaked rag across his grimy face. Then he slapped his ankle viciously, exterminating another local inhabitant. "Bloody insects. If it wasn't for the bomb, I'd let the Frogs have this stinking atoll with no arguments."

"Yes, at least then there'd be one thing that hopped rather than crawled." Billton hoped an injection of humour might lighten McWhirter's mood. It failed.

"But then, if it wasn't for the bomb, they wouldn't want the island," McWhirter continued, oblivious to Billton's comment.

"Catch vingt-deux," Billton said.

"What?"

"Catch twenty two. You know. If..."

"I know what catch twenty bloody two means. I may be a raving Greenie to you, but I can read. What was that 'vunk der' crap?"

"It was French," Billton said, exasperated.

"Thought as much. Look, we're here to spike their flaming H-bomb, not practise your schoolboy frog-speak. How long now?" McWhirter crawled to the cave entrance and peered through the screen of shrubs they had erected. He could see no sign of a search party, but surely there would be French troops out there looking for them. That was the whole point of the exercise.

"Fifteen minutes." Billton opened a water flask. "Look, we can't even be certain of that. How can we trust our information? The test mightn't be for days. God, we could be eaten alive or turn to coral before the bloody thing goes le-poof." He took a long swig, then poured water over his dusty balding head.

"Our mole's never been wrong before. He's part of the process. It's today. In... fourteen minutes." McWhirter turned from the entrance, slapped another bug from his chest and crawled back to Billton's side. "Look, you wanted this, remember? Publicity for your star hopper. Hot shot fusion drive inventor protests at the scene of the blast. 'H is for humanity – not holocaust' – God, did you really say that?"

"Angus…"

"You'll get your publicity alright. And it's me who'll get it for you, hiding on this atoll at ground zero, embarrassing hell out of the Frogs. You and your…what do you call it…Ogre..?"

"OGR…one gee ramjet."

"…whatever. Well, mister spaceman, here G stands for Greenpeace. You signed on, you're here, so make the most of it.

Billton bit his tongue. McWhirter was right…and wrong. Yes, he was here for the publicity. And with publicity…hopefully…would come fresh funding. Enough to cover the launch of the modified fusion plant to complete his dream. But it wasn't really a dream, was it? That fifteen hundred tonnes of high tech metal orbiting Earth, waiting for its heart to be inserted and brought to life, was as real as the scorpions in this damned cave. And yes, conspicuously and vehemently proclaiming his support for Greenpeace's protest at the renewed bomb tests would certainly help his cause.

But McWhirter was wrong…culpably wrong…if he thought that was the sole reason. 'H is for Humanity – not Holocaust.' Yes, he did say that. Loudly and often. And he was as committed to stopping these tests as McWhirter was, though he wished it could be done from the cool sanitary bridge of Star Endeavour and not in this…

Billton silently cursed McWhirter, the bugs and the heat. Still, it could be worse. He stared at the cave roof, picturing the daylight moon shining in the sky above, an unsmiling witness to man's continuing folly. He could be hidden in a freezing crater up there, recycling his air and urine, waiting in an unforgiving vacuum for the Chinese to find him before they detonated their bomb. Or would they even bother to search? All in all, he decided, I'm better off in this stinking hole with the crazy Greenie 'Crocodile'. 'Crocodile'? Where on earth...oh, stuff it.

"I'd kill for a decent meal. I'm sick of dry rations and warm water." Billton rubbed his rumbling stomach.

"Bloody whinging scientists. When the going gets tough..." McWhirter rummaged through his pack, then threw a muesli bar at Billton. "How you'll survive your ten years to that star on tooth paste and hydroponic cabbage is beyond me. Eat this, will you. That stomach will bring the Frogs from miles away." McWhirter crawled back to the cave entrance.

"Thanks, but first..." Billton grabbed the camp shovel and walked, half crouched, to the back of the cave. He selected what he hoped was an undisturbed patch of sand and began to dig.

McWhirter scanned the desolate surface of the atoll visible to him. The cave was well positioned on Sector Yvonne. He had a view of about 120 degrees, past the mutant coconut palms, down to the lagoon's edge. Across the doomed water he could see Sector Camellia where the main administration and science buildings hunkered into the ground for protection from their own diabolical creation.

The mission so far had been a complete success. Ten days ago, they had landed at night in the rubber duck, located the cave, unloaded their gear and sent the duck back. Then they waited. Twenty four hours before the next scheduled test, Greenpeace stunned the world with news that two protesters, the infamous 'Crocodile' McWhirter and the equally famous astro-pioneer John Billton, were hidden on the atoll, willing to risk the wrath of the submerged nuclear explosion. And this one was scheduled to be big. At least 300 kilotonnes.

The eyes of the world were once again upon Mururoa. Would the French carry out their threat to detonate the bomb regardless of the safety of two high profile non-nationals? Or would the searching Legionnaires find and drag them into the secure shelters first?

Either way, they'll have oeuf on their faces. McWhirter smiled involuntarily at another of Billton's endless schoolboy puns. Serve them bloody right too, he thought viciously, erasing the smile as his scanning

eyes caught the shadow of Rainbow Warrior II, lying broken in ten metres of clear blue water off Yvonne's shore. Four good men, friends, murdered. And Faye.

Few knew that it was Faye who had coined his famous nickname. But not for any reference to his thick skin, tenacity or cunning as the world supposed. During a rare tender moment in Wellington, looking across from her hair strewn pillow, she had affectionately commented on his 'crooked dial', and the nickname was born. Poor beautiful dead Faye.

Bloody arrogant Frogs. Once wasn't enough. After the tests in 2013, another small boating accident. But not before Faye had transmitted the location of the cave discovered during their covert survey of the atoll. Tears mingled with sweat as McWhirter stared, unseeing, into the lagoon's waters, remembering a cheap hotel room in Wellington.

His thoughts were interrupted by a surprised exclamation from Billton.

***

(End of Part 1)

What had caused Billton's surprise? Will the French bomb go le-poof or will the protestors' actions have consequences beyond their wildest dreams? Billton may wish upon a star bur remember… be careful what you wish for. Read the continuation of this story in March issue and the conclusion in April Prime Focus.

ESO Watch: Carina In Detailed Infra Red

ImageCredit: ESO

ESO's Very Large Telescope has delivered the most detailed infrared image of the Carina Nebula stellar nursery taken so far. Many previously hidden features, scattered across a spectacular celestial landscape of gas, dust and young stars, have emerged. This is one of the most dramatic images ever created by the VLT.

Deep in the heart of the southern Milky Way lies a stellar nursery called the Carina Nebula. It is about 7500 light-years from Earth in the constellation of Carina (The Keel). This cloud of glowing gas and dust is one of the closest incubators of very massive stars to the Earth and includes several of the brightest and heaviest stars known. One of them, the mysterious and highly unstable star Eta Carinae, was the second brightest star in the entire night sky for several years in the 1840s and is likely to explode as a supernova in the near future, by astronomical standards. The Carina Nebula is a perfect laboratory for astronomers studying the violent births and early lives of stars.

Although this nebula is spectacular in normal visible-light pictures (eso0905), many of its secrets are hidden behind thick clouds of dust. To penetrate this veil a European team of astronomers, led by Thomas Preibisch (University Observatory, Munich, Germany) has used the power of ESO's Very Large Telescope along with an infrared-sensitive camera called HAWK-I.

Hundreds of individual images have been combined to create this picture, which is the most detailed infrared mosaic of the nebula ever taken and one of the most dramatic images ever created by the VLT. It shows not just the brilliant massive stars, but hundreds of thousands of much fainter stars [3] that were previously invisible.

The dazzling star Eta Carinae itself appears at the lower left of the new picture. It is surrounded by clouds of gas that are glowing under the onslaught of fierce ultraviolet radiation. Across the image there are also many compact blobs of dark material that remain opaque even in the infrared. These are the dusty cocoons in which new stars are forming.

Over the last few million years this region of the sky has formed large numbers of stars both individually and in clusters. The bright star cluster close to the centre of the picture is called Trumpler 14. Although this object is seen well in visible light, many more fainter stars can be seen in this infrared view. And towards the left side of the image a small concentration of stars that appear yellow can be seen. This grouping was seen for the first time in this new data from the VLT: these stars cannot be seen in visible light at all. This is just one of many new objects revealed for the first time in this spectacular panorama.

More information

The year 2012 marks the 50th anniversary of the founding of the European Southern Observatory (ESO). ESO is the foremost intergovernmental astronomy organisation in Europe and the world's most productive astronomical observatory. It is supported by 15 countries: Austria, Belgium, Brazil, the Czech Republic, Denmark, France, Finland, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom. ESO carries out an ambitious programme focused on the design, construction and operation of powerful ground-based observing facilities enabling astronomers to make important scientific discoveries. ESO also plays a leading role in promoting and organising cooperation in astronomical research.

ESO operates three unique world-class observing sites in Chile: La Silla, Paranal and Chajnantor. At Paranal, ESO operates the Very Large Telescope, the world's most advanced visible-light astronomical observatory and two survey telescopes. VISTA works in the infrared and is the world's largest survey telescope and the VLT Survey Telescope is the largest telescope designed to exclusively survey the skies in visible light. ESO is the European partner of a revolutionary astronomical telescope ALMA, the largest astronomical project in existence. ESO is currently planning a 40-metre-class European Extremely Large optical/near-infrared Telescope, the E-ELT, which will become "the world's biggest eye on the sky".

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ImageCredit: ESO

ImageCredit: ESO

Star Trails at Ice In Space Astro Camp (IISAC) - Mike Salway

Flame and Horsehead Nebulae - Debra Taylor

Jupiter - Borislav Muratovic

Crux - Roger Powell

Musings

Stuart Cant

"This is the dawning of the Age of Aquarius"

These words are the beginning of a song from "Hair" which premiered during the Vietnam war. The title of the song, "Aquarius", refers to the First Point in Aries, gradually moving into Aquarius as the Earth's axis slowly precesses in its 25,800 year cycle.

During the winter months can see Vega (α-Lyrae) low in the north. I don't get good look at it because two houses and a tree behind mine obscure the view, but I see the star as it passes over their driveways.

After searching my study, I retrieved an article in Australian Sky Telescope (May/June 2008: "Polestars of the Future - a Journey in a Celestial Time Machine") and I read that Vega will be (approximately) the North Pole Star about 13,000 years from now. At that time, Polaris (α-Ursae Minoris) will visible from my backyard. Unfortunately I won't be here to see it, unless medical science makes some amazing new discoveries.

The South Pole Star will be Canopus (α-Carinae). Where will the First Point be then? The obvious answer would be to follow the ecliptic around to Virgo or Libra. On giving that some thought, I realised Ecliptic would be nowhere near those constellations. The celestial poles move in a great circle 47° in diameter, and the ecliptic and celestial equator would be tilted by the same amount. Ursa Major would be over the equator and clearly visible from my backyard. When Vega is near the North Celestial Pole, the equator will pass between Scorpius and Ara, and through Centaurus and Norma.

I don't know where the ecliptic will be, so my thought experiment concentrated on the equator. Maybe the signs of the Zodiac will be Bootes, Cassiopaea, Draco, or Ursa Major.

These facts and figures are only approximate. I would be interested to see someone with appropriate computer programs work out more precise figures.

About AD 25,000 the South Celestial Pole will be on the edge of the Small Magellanic Cloud.

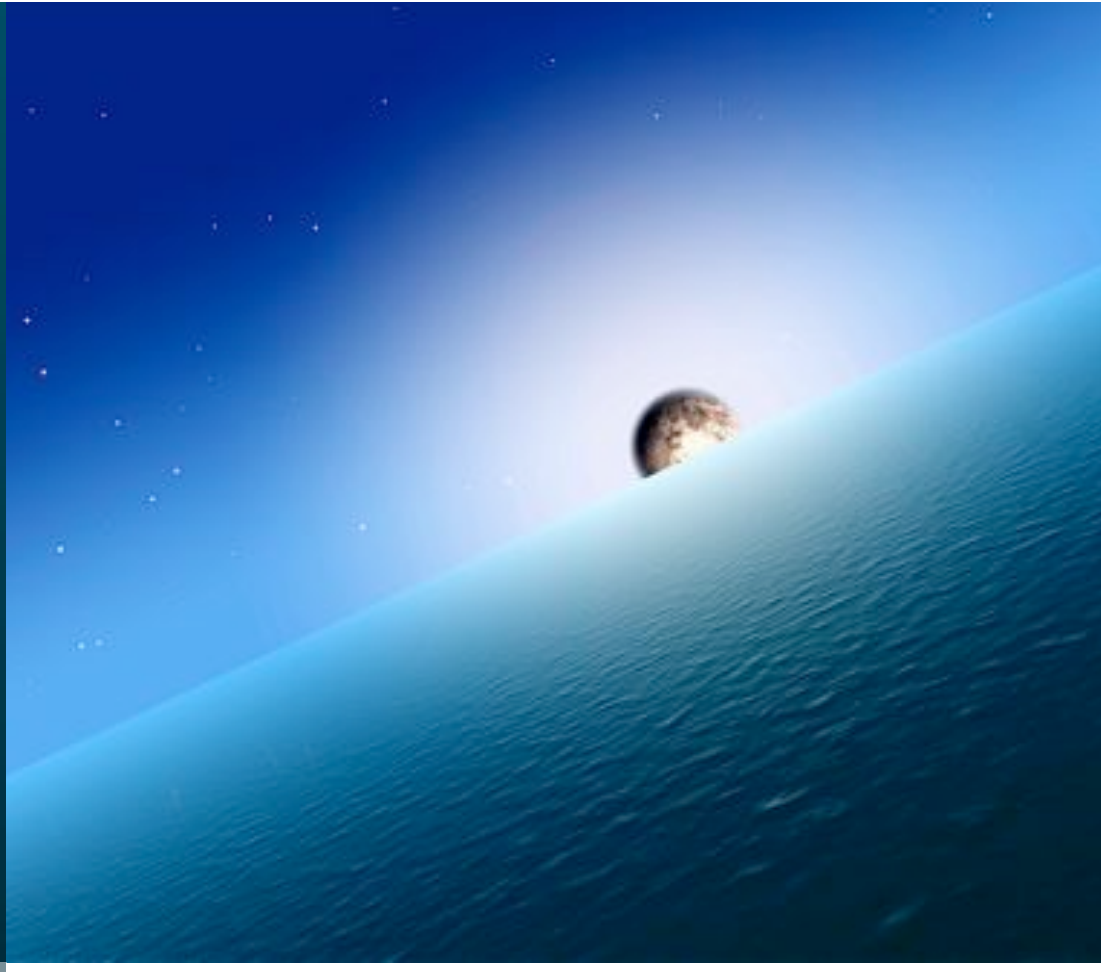
To the Editor, via email:

P.S.

After I wrote this article, I realised the ecliptic would be the same during its 26,000 year cycle, but I am sure I was right about the celestial equator.

Never mind, it was an interesting exercise to visualise the Earth as a spinning top in a cartoon-style simulation (which can illustrate a point better than a photographic animation). When I added the place of the Earth's orbit to my "waking dream" I spotted my error.

Stuart



macarthur astronomy forum

February's Meeting

Guest speaker at the Macarthur Astronomy Forum in February will be **Dr. Lucyna Chudczer** (University of NSW).

Here is Dr Chudczer's talk synopsis:

"Following the water trail - the search and characterisation of habitable extrasolar planets"

"Close to a thousand exoplanets have been found since the discovery of the first planetary system around pulsar PSR 1257+12 by Wolszczan in 1992, followed by the detection of a planet around a Sun-like star, 51 Peg, by Mayor and Queloz in 1995.

"With the launch of the Kepler telescope, we are now capable of finding Earth-size worlds around other stars. But how do we know if these Earth-like planets have all the right ingredients for life like ours to flourish? I will describe the spectroscopic and polarimetric methods used to characterise planetary surfaces and atmospheres.

"To date, such observations have been possible for the largest planets, classified as hot Jupiters. However, new precise instruments are being developed that can obtain the spectra of much smaller planets, allowing us to resolve the habitability question of Earth-size planets around other stars."

MAS Shop

Advertisement

Our Merchandise Officer, Stewart Grainger, currently has the following official MAS merchandise items on sale:

'**Astronomy 2011**' is a must have book - available now. $25.00 (members $20.00).

MAS coffee mugs: now available for $12.00 (members $10.00).

m a g n i t u d e][: Our second DVD - $14 (members $10)

MAS polo shirts: available in navy, black or white (mens or ladies, various sizes): $40.00 (Members $35.00).

MAS baseball caps: $25.00 (Members $20.00).

MAS beanies: $20.00 (Members $15.00).

MAS sew-on badges: (105 mm x 60 mm) available in white on black and black on white: $10.00.

'**Ice In Space '2009 Compendium'**: a timeless compilation of astrophotographs by members of IIS in an 80-page coffee table book - (retails $50) $25

Starwheels: ("Planispheres") large $25.00 and small $15.00.

'**Heaven's Above - A Binocular Guide to the Southern Skies**': a top-selling book by MAS member Bob Bee: available on public nights for $18.00.

'**Emu Dreaming**': a book about the interpretation of the southern sky as seen by the Aboriginals: was $15.00 - now reduced to only $10.00.

'**Prime Focus**' is our flagship publication - available now. Back-issues available until sold out. $6.00 at meetings.

These items are on sale at general meetings, or by arrangement. Please contact Merchandise Officer Stewart Grainger - either by Private Message via the website forum or by email to:

merchandise@macastro.org.au

Let him know what you want to buy and make arrangements to pick it up from him. Please note, it is not possible for Stewart to bring every stock item to every meeting.

Heavens Above!

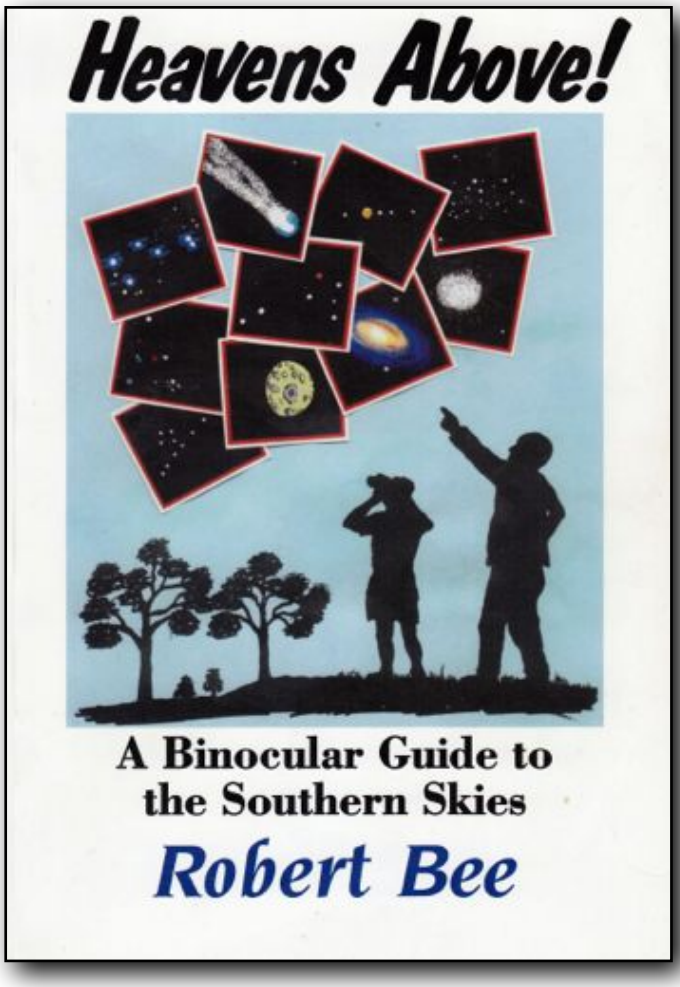
Advertisement

It is a very common misconception by people on the fringe of amateur astronomy that you absolutely need a telescope to "see anything interesting".

This book comprises 158 pages and contains over 80 diagrams of the sky viewed from the Southern Hemisphere

In the book, the author takes you through all the constellations visible from the Southern Hemisphere which have objects visible through binoculars.

The planets and many globular clusters, open clusters, gaseous nebulae, galaxies, double stars and



asterisms can be found with your humble field glasses.

This book contains:-

- charts showing 56 of the 88 constellations with the locations of binocular objects they contain and description and details of each object.
- maps of each month of the year showing the location of the constellations in the sky to the north and south

This is an excellent introduction to observational astronomy for beginners of all ages.

To purchase your copy of this excellent book please forward your cheque or postal order (made out to Robert Bee) for AU$19.50 to the author at the address below.

This includes postage and handling (within Australia).

Please contact Robert Bee at rmbee99@hotmail.com for more details about the book or Direct Deposit information.

Robert Bee,

8 Joseph Banks Court,

MOUNT ANNAN, NSW, 2567

About the Author:

Robert Bee lives at Mount Annan on the south-west outskirts of Sydney, NSW.

Robert's passion for astronomy began in his teens and has deepened over the ensuing years. With degrees in Electrical Engineering and Science, he enjoys both observing the starry sky and understanding the physical laws behind what he sees.

Robert is a member of the Macarthur Astronomical Society (MAS) and has edited and contributed to the Society's monthly journal "Prime Focus" since it commenced in 1996 up to 2006. He has carried several positions within the Society during that time.

He shares his passion for astronomy with the people of the Macarthur Region through a fortnightly column called "Heavens Above!" in the Macarthur Chronicle newspaper. This column commenced in 1998 and is aimed at those with no background in science or astronomy, just a sense of curiosity and a willingness to step outside the back door and have a look at the sky.

Robert also enjoys writing fiction, with a preference for science fiction and fantasy, and has had a number of short stories published in periodical magazines and successes in short story literary competitions. He currently has a children's science fiction novel, with an astronomy theme of course, in progress.

Robert enjoys talking to the public about astronomy and guiding them around the sky, both at public nights run by MAS and also at clubs, societies and schools.

Members Observing Nights

Make sure you remember to bring your cardigan.

Even in Summer, it can still cool right down at night!

On observing nights, at any venue, you must arrange your own transport and please try to arrive well before sunset, to enable you to familiarise yourself with the surroundings before darkness sets in. If arriving later, make sure that your approach to the final gate is only with parking lights and ask someone to guide you into the observing area from the gate. It is essential - for your own safety and that of others - that you bring a red torch with you to observing nights. If weather conditions look doubtful, please check the website "What's On" page before leaving home. If Stargard is cancelled, sometimes an unscheduled observing night will be held later that week.

During the course of the evening, please consider the needs of others around you, especially when using laser pointers, camera screens, computer monitors, car boot lights etc. Please read our Field Etiquette page on our website for reference.

Stargard nights are free to members and invited guests. Please contact the President before inviting anyone. Beginners are encouraged to observe at Stargard before progressing to the Forest.

To cover our costs, the charge for The Forest is $15.00 per member per evening, whether attending just for the evening or staying all night. Experienced amateur astronomers who are non-members may be invited to attend the Forest subject to prior clearance from the President and will be charged $20.00 per visitor per evening. Please see Ned Pastor on your arrival to make your payment and please try to have the exact amount.

Limited sleeping accommodation is available but not guaranteed. 240vAC field power is available (bring your own waterproofed extension leads) as are kitchen and washroom facilities.

Stargard- ImageCredit: Roger Powell

M.A.S. HYSTERIA !!!