PRIME FOCUS

MAS SOCIETY JOURNAL

macarthur astronomical society

Mar 2012

volume 17 issue 3

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

From the Editor's Desk

Welcome to the March 2012 edition of Prime Focus - "volume 17, edition 3".

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 so that it will scan properly.

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**.

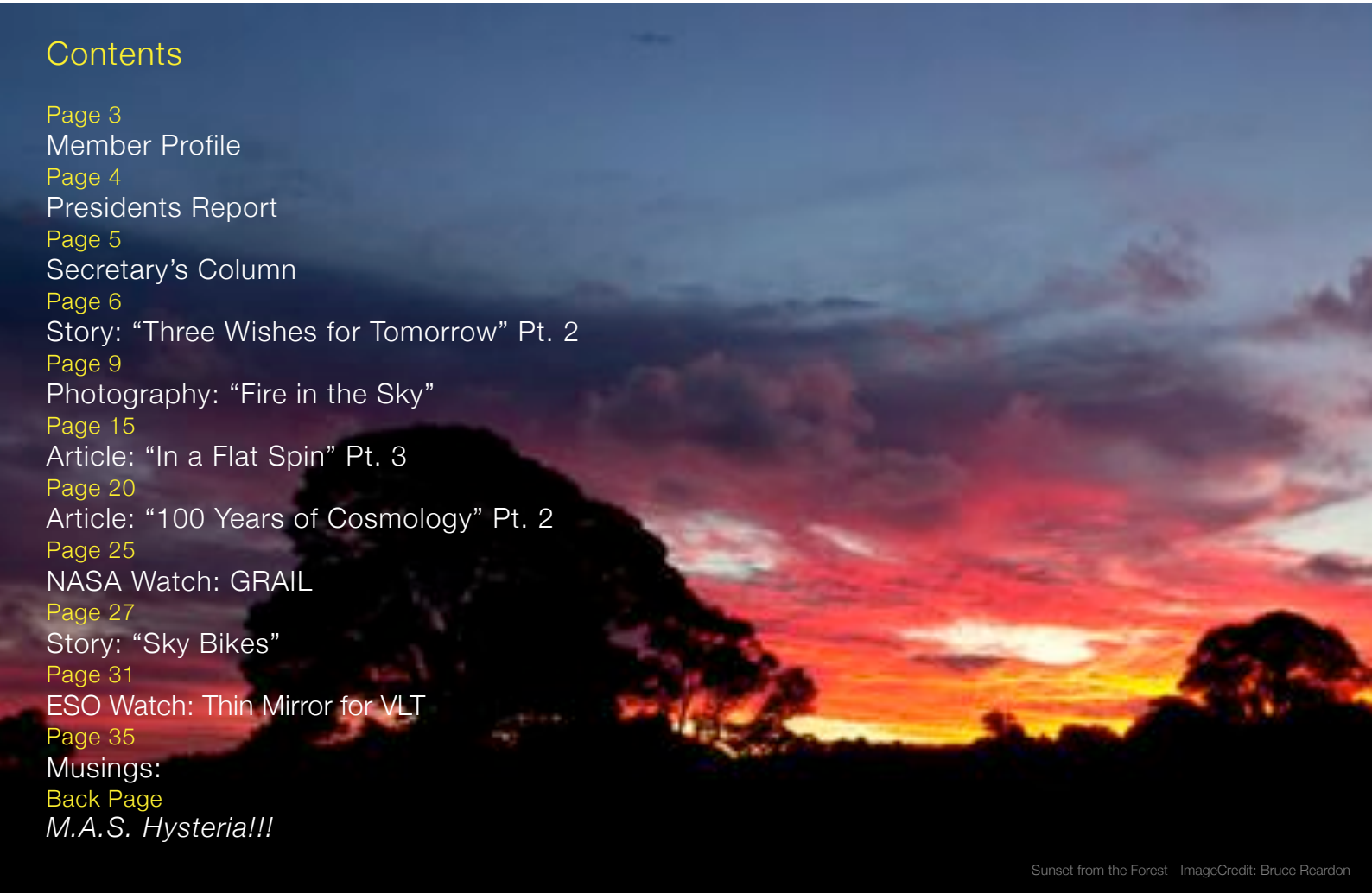
If amateur astronomy-related vendors would like to advertise in Prime Focus please send an email to the Secretary with your details, and we will endeavour to come back to you with a suitable plan.

Prime Focus is now packaged as a folded centre-stapled magazine for the first time. I'd like to thank Greg McCabe from Macarthur Print (Kwik Kopy) for taking this initiative - it is much appreciated!

Please enjoy this March edition - our third for the year 2012.

Clear Skies!
Chris Malikoff

Contents



Sunset from the Forest - ImageCredit: Bruce Reardon

ImageCredit: Robert Leonard

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Member profile - Trevor Rhodes

As a child, my bed was directly under a window that was only ever closed when it rained. I laid there for hours looking backwards with my neck bent. I remember when I was about 8yrs old, my mother wanted to rearrange the room until I begged her not to. I don't ever think I wanted something so much back then. Night time was my escape from the horrors of the day (meaning school and schoolteachers). None of my friends ever talked about astronomy and my family didn't understand my fascination either. Episodes of Jet Jackson and Lost in Space were replayed in my head night after night.

I had never seen a telescope, but that didn't stop me seeing in my own mind, the wonders of the universe. Fast forward 30 years and you would see me buying what many people call a Kmart Tasco. I went through every telescope they sold in about 2 months. It just wasn't good enough and the prices I saw in the magazines looked more like telephone numbers to me. Fast forwarding another 15 years and I was walking around at the Campbelltown Show when I came upon the MAS Display.

That was the day everything took shape. I was hooked. I think I spent more time there talking to the members on duty than I did at my own stall, much to the annoyance of my volunteers who had to take over. A few months later and I had learnt enough from people like John Rombi, Roger Powell and Bob Bee to make an informed purchase of my own. Today I am the proud owner of a 12" Collapsible Skywatcher Dobsonian and I just can't get enough. Although I have a rudimentary astro-photography setup, my heart lies with the visual.

My other love I found after becoming a member is Public Nights and Outreach Events. There is little that is more satisfying than the ooh's and aah's of wondrous first time viewers. Especially the children who can go from bored to bug-eyed after one glance through an eyepiece. I look forward to many more years out in the field with the good friends I have made since joining MAS.

Here's to clear skies and dry mirrors.

Trevor

president's report

TREVOR RHODES

Hello Members.

We're one month out from our Annual General Meeting to be held on April 16th. It is with regret that I inform you that I am standing down as President and from the Management Committee. I have spent the last three years on the Committee and have enjoyed every minute of my time. This year though, I feel I need to get back to Astronomy as a hobby. I look forward to seeing you all out in the field very shortly.

This month will see Les Dalrymple return as Guest Speaker speaking about the observational history and present state of knowledge as it relates to the major members of the Centaurus A / M83 cluster of galaxies. For anybody as interested in this as I am, it promises to be very informative.

Other upcoming events are Public Nights at Dudley Chesham Oval at The Oaks on 28th April, 28th July and 20 October. Please, if you can help on any of these nights, let me know and I'll keep you informed as the year progresses. One other night planned for Fairvale High School (Fairfield West) will be held on Wednesday 22nd August. Again, please let me know if you are willing to help out.

We are also hoping to arrange a couple of viewing nights away as visitors of Sutherland Astronomy and Western Sydney Astronomy Societies. More details will become available once dates are settled. Please contact John Rombi via PM on the forum if you wish to participate in the upcoming Globular Hunt Marathon. We would like to make this an annual event if there are enough takers. Otherwise it just might be John and myself out there 'till dawn.

Lastly, I would like to remind everyone that membership fees are now past due. Please see Tony Law at the meetings or contact him via PM on the forum for advice on how to take care of your membership before we get any further into the year.

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

Trevor

Membership Expiry

Membership for 2011-12 expired on 29th February. Many thanks to those members who have already paid the membership fees. Unfinancial members are advised that they have until 30th April to renew their membership, following which a rejoining fee will be applicable.

The fees for 2012-13 have again remained unchanged and can be paid to the Treasurer at the next Macarthur Astronomy Forum or by mail to: The Secretary at PO Box 17, Minto, NSW, 2566. We are experiencing some difficulties with the PayPal facilities on this website, due to circumstances beyond our control.

Not sure how much to pay? Please see the 'Join MAS' page for schedule of fees. You must be a current financial member to participate at the AGM.

Not able to come to the meeting? Contact Tony or Roger for instructions of how to transfer on-line.

Annual General Meeting

The AGM will be held on Monday 16th April, when an election will be held for office-bearers for 2012-13. Nomination forms are available from the secretary and completed nomination forms must be received by the Secretary on or before Monday 2nd April.

secretary's column

ROGER POWELL

I give notice that the Annual General Meeting of Macarthur Astronomical Society will be held on Monday 16th April 2012 at 7.30 pm in Building 21, UWS, Campbelltown, commencing at 7.30 pm. Nominations for election of office-bearers close on Monday 2nd April.

That's next month and before that, of course, we have our March Macarthur Astronomy Forum coming up, on Monday 19th March. This meeting and all meetings for the remainder of the year will be held in Lecture Theatre 6, Building 21 at UWS Campbelltown. This is the best venue, both for members and for visitors - it is ground floor access, right next to UWS Car Park P6. Just park near the building and you can walk straight in. No steps, stairs or lifts - this lecture theatre is ideal for 'disabled access' and is a very suitable place to welcome the high stature guest speakers who come to the Forum. Maps are available on our website if you have not been to Building 21 before. Many thanks to UWS for making this room available.

Our March guest speaker will be Les Dalrymple, a highly experienced amateur astronomer. Les is a member of Sutherland Astronomical Society; a contributing editor at 'Australian Sky & Telescope' Magazine; and a guide lecturer at Sydney Observatory. Les gave an inspiring talk to us last year about globular clusters and we are looking forward to another great evening with him.

We enjoyed a great talk from Dr. Lucyna Chudczer last month about the search for 'Earth-like' planets. Lucyna astonished us all with the clever scientific methods that are now being developed to determine the atmospheric fingerprints of these remote worlds orbiting other stars. I couldn't quite keep up with all the graphs Lucyna showed but it sure was an interesting talk!

Australia has certainly developed an extraordinarily talented pool of professional astronomers. Many of these are attached to CSIRO, the University of Sydney or the University of NSW. Bryan Gaensler, Geraint Lewis and Fred Watson - all regular visitors to MAS - are amongst the leaders and there are many more across Australia. John Rombi, our Speaker Liaison has been tapping this rich wealth of expertise to bring the best communicators to MAS.

In particular, John has been negotiating for several months with Professor Brian Schmidt's staff, to persuade him to talk to the Macarthur Astronomy Forum. Brian is based at the ANU in Canberra and this month and John recently had a private conversation with him and received a personal commitment that he would indeed come to MAS, on a date to be arranged in 2013. This is fantastic news for MAS; and Brian will have the distinction of becoming the first Nobel Laureate to address the Macarthur Astronomy Forum - but hopefully not the last.

Coming up in June will be the transit of Venus across the Sun. These events come in pairs every hundred years and your next opportunity to see one will not be until 2117, so make the most of it. Details of this event are on the front page of the website. As this is a week-day, day-time event, the Committee is undecided on whether to hold an MAS event or just leave it to individuals to view from their homes. Either way, it is a must-see event and worth taking a day off work for! Remember, viewing the sun without the right equipment can lead to permanent eye damage, so members are urged to plan ahead. If you are looking for a solar filter to add to your telescope, make sure it is one which attaches to the light receiving end of the 'scope. Do not risk your eyesight by using a filter which attaches at the eyepiece.

The Dharawal National Park has still not been declared. There seems to be a slight delay but there seems little doubt that it will happen. Once the declaration is made and the old State Conservation Area becomes a new State National Park, the National Parks and Wildlife Service will begin to formulate a new Plan of Management. When the draft plan is made available for public comment, it will be the time for MAS to make a submission to NPWS for astronomy to be included as one of the activities which can be pursued there. At the moment this is not the case.

As one member recently pointed out to me, astronomy is only suited to large unpopulated areas around the outskirts of Sydney. Most of these areas are owned by NSW Government agencies, which ought to be making such areas available for the pursuit of astronomy as a matter of course, rather than by pleading for inclusion in a management plan. He made a good point.

Just a reminder that 2011-12 memberships expired on 29th February. I would like to ask the few remaining members who have not yet renewed, that they do so before the end of next month, otherwise they will unfortunately face paying a new member's joining fee.

Schedule Planner

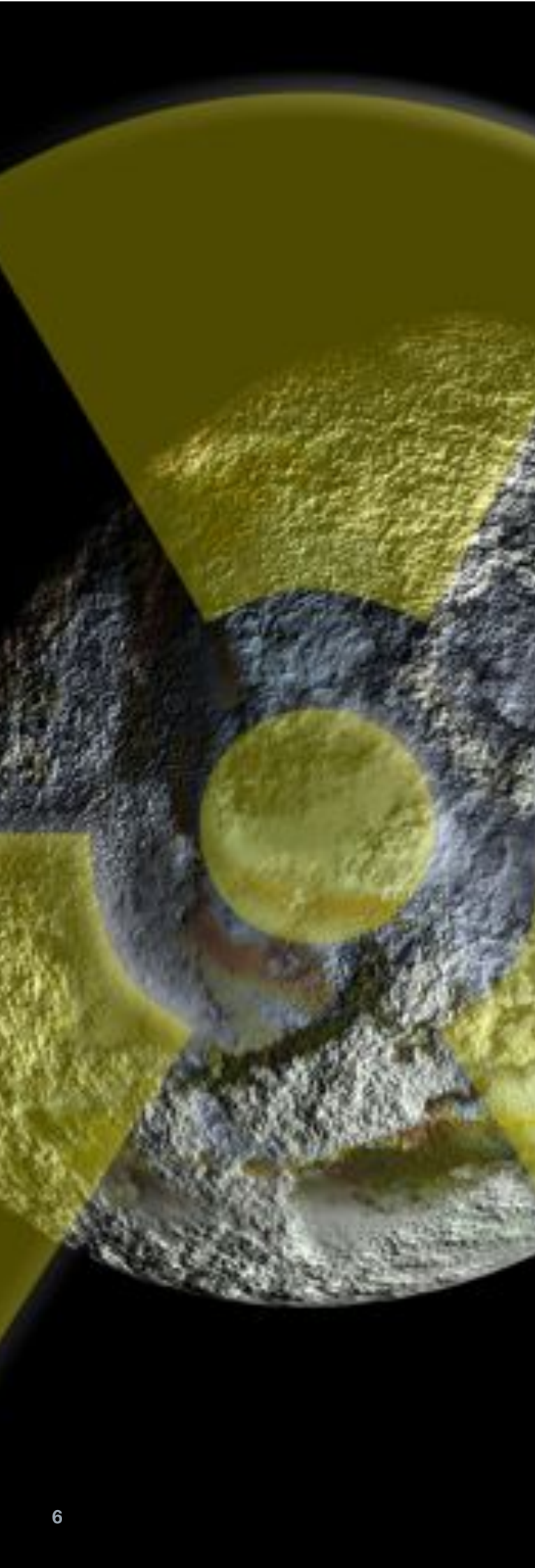
March 2012

19/3/2012
Macarthur Astro Forum

23/3/2012
The Forest (Fri night)

24/3/2012
The Forest (Sat night)

25/3/2012
The Forest (Sun night)



"THREE WISHES FOR TOMORROW"

PART2

(The continuation of a short story by Robert Bee)

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

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McWhirter had lost all patience with his companion. Their earlier firm friendship was but a distant memory now. Ten days in a hole leaves plenty of time for discussion. And heated argument.

McWhirter couldn't see the point of travelling to the stars…or more accurately, a star…when there's no guarantee of somewhere to land when you arrive. Hell of a risky investment for trillions of dollars and a lifetime in one-way travel. "We're confident there's a planetary system," Billton had explained. "The star's perturbations indicate a Jupiter size planet at twice Jupiter's distance." They had argued through the night on the proposition 'where there are Jupiters, there will be Earths.' To McWhirter's debate stopper "send me a post card when you land," Billton had floored him with "you'll have aged two hundred years before I'm ten years older, Angus" and went on to explain relativity and time dilation at great and boring length. Two hundred years! What's the bloody point?

And Billton's passionate defence of the new fusion power stations. He actually supported their construction and believed they were the answer to Earth's energy crisis. Perfected containment fields be damned. Endless and clean energy my fungied foot. One failure of their triplicate protection systems, and a microsecond later… nothing but atomic dust. Madness! Hydrogen power and hydrogen bombs. They were all the same to McWhirter. All to be stopped. How could he have been so wrong about a man?

Ten thousand square kilometres his ramjet scoop would have to be, Billton had told him. His design was the "engineered realisation of Bussard's wild dream back in the 1960s." Whoever Bussard was. All to collect interstellar hydrogen to fuel the fusion rocket to maintain one gravity acceleration and approach near light speeds. Ergo, One Gee Ramjet. Or, as Billton had characteristically named it, the Relativistic One Gee Reaction Ramjet. ROGR Ramjet. God save us from punsters. All he needed was the fusion generator to power the scoop's field. "Impossible," McWhirter had said. And Billton had just given him one of those infuriating smiles and said, "Angus, nothing is impossible."

"What now, damn it?" McWhirter snapped at Billton's gasp of surprise from the back of their cave.

"This." Billton held up an encrusted object about the size of a football boot. "It's heavy. Feels metallic." He
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crawled back to McWhirter, curiosity erasing the original errand from his mind.

"Careful. It may be an old shell. Or a mine." McWhirter backed away, but came up hard against the cave wall, only a few metres from Billton.

"At Mururoa? Don't be daft. There was no action here." Billton used his knife to scrape away the excess dirt and coral, exposing a dull coppery surface. Engrossed with his task, he continued scraping, until the object was completely free of detritus.

Both men sat back on their haunches and silently stared at the oil lamp Billton held in his hands. It had a dull finish but appeared to be covered with delicate filigree. Along one side, there was the suggestion of written characters.

"Are you thinking...?" Billton left the question hovering in the heat.

"Now who's being daft? You've been down this hole too long, mate." McWhirter reached out for the lamp. "It's obviously an old native lamp from before the '66 tests. Gimme. I'll clean it up a bit." He wet his sweat rag with some canteen water. Billton, his curiosity burning, did the same, and they both bent over the old lamp, cleaning its surface in unison. The pair's first co-operative act in a week.

Their vigorous efforts were soon rewarded. The old copper surface began to shine with renewed lustre. Satisfied, they sat back to admire its lines. Then they noticed that the shine became a glow, taking on an iridescence like the tip of a blow torch. Its surface mottled, appeared to flow like molten metal, rippling through all the colours of the spectrum, and then some more.

There was a distinct shuffling noise in the cave. McWhirter and Billton watched astonished as all the creeping life forms on the ground, the walls and the ceiling made direct and hasty paths to the cave entrance, to disappear out into the forbidding daylight.

"Um...Angus..." Billton's mouth was uncomfortably dry from a feeling he hadn't experienced since his first shuttle launch.

McWhirter hissed him to silence. "Do you hear something?"

At first Billton thought he meant the insects. Then he listened harder. The insects had all gone. Now there was a new sound, like the approach of a distant locomotive. No. Like a rushing wind up a canyon, or a flash flood down a dry gully, just around the next bend. It grew louder as the lamp glowed a bright cherry red, blanking out the dim shadows on the cave walls. The sound was now so loud, Billton felt either the lamp or his ear drums must surely burst.

Silence struck like a guillotine.

Both men fell on their backs from the sudden release of tension. Their eyes kaleidoscoped with after-images dancing across the cobwebbed ceiling. A haze of mist... or steam... permeated the air. And the strong pungent smell of... incense?

"Masters." A voice deeper than the Mariana Trench filled the cave.

McWhirter was the first to struggle upright. "Jesus!" he said. And stared.

Billton slowly shook his head. "I don't think so."

An apparition sat cross-legged before them. A huge silver turban, perched on an equally large black cherubic head, brushed the ceiling. An immense chest and belly were exposed beneath a gold trimmed ultramarine vest. In its navel sat a jewel to shame the Hope Diamond. Bulging purple pantaloons threatened to float him away, while the silver pointed slippers matched the turban for ridiculousness.

"You see it too?" McWhirter asked hopefully.

"Unfortunately, yes. Either we're both mad or..."

"Masters. Your wish is my command," the apparition intoned, while bowing impossibly from its sitting position.

"I wish it hadn't said that," McWhirter muttered. "Now I know we're crazy."

"You cannot unwish that which is already fulfilled," the bass voice said.

"What? I didn't wish anything, you... what are you anyway?"

"I am the Genie of the Lamp."

McWhirter and Billton scurried across the sand to sit together, a team again, staring at the... genie. As professionals in their fields, they had seen many strange things. Things Aesop, Brothers Grimm and Disney could never imagine. But, eventually, all had been rationally accounted for. The Extraordinary was the Explainable. Sceptics ruled.

Now, a Genie from a lamp, in a cave on Mururoa Atoll, with a 300 kilotonne fusion reaction only... ten minutes away?

"Um... our wishes, you said?" Billton broke the strained silence.

"Three wishes, Master." The genie nodded its massive head.

"Get a grip on yourself, Billton," McWhirter turned on him. "He's an hallucination, a figment..."

"Maybe, let's see how the figment cooks," Billton said. "I'm famished. I wish for a baked dinner, roast beef and vegetables, for two, and chilled chablis. Chop chop."

"Three claps and Kazaam," the genie rumbled.

"Pardon?"

"Not chop chop. You must clap three times and say Kazaam."

McWhirter's sudden burst of hysterical laughter caused the genie to raise one devilishly pointed eyebrow. "This Master is ill?"

McWhirter struggled for breath. He slapped Billton on the back. "Oh, don't mind me, mate. Kazaam away." He collapsed into spasms of laughter again.

CLAP. CLAP. CLAP. "Kazaam." Despite his determination, Billton mumbled the word, belatedly feeling very foolish and desperately hoping there was no candid camera to record his moment of embarrassment.

"Done. Two wishes remain, Masters."

The delectable aroma of roast beef, potatoes and pumpkin, and steamed beans and corn filled the cave. McWhirter wiped his tears and stared at the golden plate heaped with juicy hot food at his feet . A gold chalice full of wine stood beside it, beads of condensation running down its sides. As in a dream, he lifted the chalice to his lips and sipped.

"Chablis. Tyrell's '17," he pronounced. "Good year."

"Close. '18," the genie said.

Without hesitation, Billton began to demolish his food. He quaffed the chablis like a man who hadn't had a decent meal in two years, not two weeks. With a piled fork halfway to his mouth, his whiskered chin dripping juices, he stopped. McWhirter hadn't touched his food since sipping the wine.

"Come on man. Eat. It's real," Billton prompted.

"I know it's real. I don't have time to eat."

"Time?"

"What? Five minutes? Four?"

"For what?" Billton lowered his laden fork.

"To use the next wish. To stop the bomb."

Billton stared at McWhirter with a mixture of awe and fear. "You're going to Kazaam away the bomb? What makes you think he can do that?" Billton said, pointing at the silent genie.

"You're eating the evidence."

"Even if it works, you've only got two wishes. The French have hundreds of bombs."

McWhirter smiled an old smile. "You know John, you could always think smart, but never think big."

Billton let the inanity of that comment pass. "What are you...?"

"This is our chance to stop it. All of it. Right here." McWhirter's eyes blazed with evangelical zeal. John the Baptist. "We can stop this bomb, all future bombs... even the fusion power stations."

"The power... No, they're beneficial. They..."

"What a crock." A fleeting smile, quickly erased. "They're Chernobyls and Jervis Bays waiting to happen. I can stop them all, present and future. With one well phrased wish."

Billton stared at McWhirter. "The bombs...alright. If he can do it. But leave the fusion stations out of it. Angus..."

"Genie," McWhirter said. "Can you do it? Are you that powerful?"

"All things are possible to the Genie of the Lamp." The deep voice was as cold and impassive as the waiting black face. "Your wish is my command."

"How long?" McWhirter turned to Billton.

Billton checked his watch reluctantly. "Two minutes."

"Bugger. No time to be fancy." McWhirter closed his eyes and concentrated. "You're the rocket scientist. What's the most basic process in an H-bomb?"

"Hydrogen fusion. Conversion of hydrogen to helium."

"What about uranium?"

"That's fission, A-Bombs, atomic power stations."

"I'll deal with those next wish. First the H-bombs." McWhirter rubbed his hands, grabbed the chalice and chugged its contents. "There's Earth, the Chinese Moon base and... aren't the Yanks building a base on Mars?"

"Yes, but I doubt..."

"Just in case. I'm going to spike all their barrels."

"How?"

"I'm going to wish the permanent cessation of all fusion reactions on Earth, the Moon, Mars. For ever."

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(End of Part 2.)

Is the genie really that powerful? Will McWhirter be able to Kazaam the wish before the French detonate the bomb? What disaster lurks in the wording of the wish? And will Billton realise his dream of interstellar travel after all? Find out in the concluding Part 3 in next issue of Prime Focus.

"Fire In The Sky"

by Australian amateur Rick Stevenson

I was fortunate enough to participate in Professor Fred Watson's recent "Fire in the Sky" tour of Scandinavia, organised by the extremely capable and entirely unflappable Marnie Ogg. We had a fantastic trip, traveling through Norway, Sweden, Denmark and Iceland in late winter, along the way visiting sites of astronomical significance including the Esrange Space Centre, Kvistaberg Observatory in Uppsala and Tycho Brahe's observatories on the island of Hven. We also participated in activities such as snow shoeing, dog sledding, cruising on fjords and clambering across rivers and up glaciers in super-jeeps, not to mention a beer at the northernmost brewery in the world. Despite the fantastic scenery and amazing activities, the highlight of the tour for me was seeing and photographing the Aurora Borealis on four separate occasions in the far north of Norway.

The first glimpses of the "tricky lady" were from the car park of our hotel in Alta (69∞56'N) on the first night of the tour. Unfortunately, still tired after the long trip from Australia, I went to bed early, failed to respond positively to a wake-up call and missed this completely. On the second night we travelled to two locations on Alta Fjord for our first proper views of the Aurora. Despite some serious light pollution at the first location (especially from a ski jump which was apparently open all night) and gale force winds at the second we spent several hours drinking in the slow moving bands of light in the sky.

After Alta we headed slightly south to Lyngen Lodge on the beautiful Lyngen Fjord. This was an ideal location for Aurora watching and we had two fantastic nights of gourmet cooking and excellent wine with fine auroral displays between courses and for many hours after dinner. From Lyngen Lodge we moved to Tromsø and that night we had the finest display ever despite a bright moon and a relatively poor location, a soccer field not far from the city lights. The Aurora that night was so bright we could see it through the bus windows as we drove out of the city. Unlike previous nights where the lights were relatively slow-moving, this time there was lots of action with tendrils and curtains of light tangling, writhing and scintillating across the sky.

That was the last time we saw the lights. We had hoped to see more later in the trip, especially in Iceland, but the overcast weather prevented any chance of it. Still, we were very lucky to get those four great nights and for me the trip was a dream come true. It would have been a great trip even without the lights, but with them it was truly amazing.

If you get to the NACAA conference at the University of Queensland this Easter, Ray Johnston will be giving a talk about the tour. I'm sure it will be the next best thing to actually being there, so don't miss it!

Above Alta Fjord in gale force winds. Enhanced by unplanned light painting with a red LED torch.

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

The Lights across the fields at Lyngen Lodge

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

This huge loop formed and slowly shrank to nothing. Also at Lyngen Lodge.

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

The Aurora completes successfully with a bright move from the soccer field at Tromsø

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

The Tricky Lady dances for the last time.

"Fire in the Sky" trip with Fred Watson. ImageCredit: Rick Stevenson

"In a Flat Spin"

Part 3

THERMODYNAMICS: CAN YOU REALLY GET SOMETHING FOR NOTHING?

A SERIES OF ARTICLES BY DAVY JONES

The Laws of Thermodynamics are immutable corporeal laws - everything in the cosmos is subject to them. Just like gravity or time - nothing in the universe is free from these immutable laws. Having established fairly decisively that perpetual motion is a physical impossibility, one must then surely ask: How then does everything within the universe, and possibly the universe itself spin endlessly? Is the universe and all it contains one big perpetual motion machine? What drives the cosmos? Is there one set of 'rules' for the Universe as an entity - and another for what is contained within the universe?

Asking these questions often elicits a similar set of narrow responses: gravity - magnetism - the big bang, or answers relating what would happen if celestial bodies didn't spin. Whilst there are inevitable elements of truth in the responses - they do not directly explain the reasons why. Perhaps there isn't a simple reply; but there are many interesting avenues to explore and fascinating research linked to the whole concept of universal motion.

The English language itself often creates basic misunderstandings for recipients of information. Take for example the term: "Black Hole". Many responses to this term predictably include mental images such as - whirlpools in space - inescapable holes in space - or something else similar to a Hollywood representation. We tend to think in a flat two-dimensional frame - rather than in true three dimensions. The term black hole is a misnomer in many regards; a black hole is in fact a spherical abnormality - a massive gravitational force - in the fabric of space. It is obviously invisible, and it will draw material into its maw from any conceivable direction. This is a reasonably obvious conclusion, given that in the first place the abnormality was evidently created by the collapse of a star. Taking this point to its obvious conclusion - rather than there being, as we are so often reminded, a super-massive black hole at the centre of galaxies - it would be better suggest that originally there was a super-massive proto-star. In the process of collapsing, and going super nova, a black hole was formed. The ejected remnants from this massive super-nova then provided the material to create a galaxy! If we are to describe anything, we should first ensure our language and subsequent descriptions are as close as we can get to correct. And so it is with motion...

The type of motion most commonly associated with the concept of perpetual motion is 'spinning'. However, motion can be classified into at least seven discreet types, these being: rotary motion as a turning wheel - circular motion as orbiting planet - linear motion as moving in a straight line - reciprocating motion as vibrating or sawing - oscillating or simple harmonic motion as a pendulum - Brownian motion as in the random movement of particles - and curvilinear motion, motion along a curved path that may be planar or three dimensional. Considering the cosmos, can true linear motion occur in space - or must a course finally curve? Is anything in space motionless?

In laying the groundwork for understanding motion, it is necessary to blow the dust off of a few musty historical facts on which to build our awareness. To appreciate how basic misinterpretation of natural laws and how they apply, affects the course of history, we have to go all the way back to Aristotle. Here too we learn how easy it is to be misled by simple ignorance,

for it was Aristotle who supposed that matter would move only so long as force was applied.

What Aristotle failed to take into account was that on Earth inertia is affected by the effects of gravity and friction; both of which will decrease speed and impede movement. Whilst this Aristotelian philosophy was occasionally disputed over a period of some two thousand years - it nevertheless held sway as the populist view up until the time of Galileo Galilei (1564-1642), and his contemporary, Rene Descartes (1596-1650). Without going too deeply into this historical period and its trials and tribulations with religion and the science of the day, suffice to say, the scientific work of the aforementioned gentlemen culminated in Descartes' tome: The Laws of Motion and the Cartesian Conservation Principle - 1644. It was this work that the redoubtable Sir Isaac Newton (1643-1727), based his laws of motion upon. Newton's three laws were simple enough as follows:

1. An object at rest will remain at rest unless acted upon by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

2. Acceleration is produced when a force acts upon a mass. The greater the mass of the entity being accelerated the greater the force required to accelerate the entity.

3. And everyone's favourite - For every action there is an equal and opposite re-action.

During this same turbulent historical period, Tycho Brahe's protégé, Johannes Kepler (1571-1630) first established the set of rules that govern our understanding of planetary motion. Whilst much of Kepler's work has long been discredited, his work on the laws planetary motion still stand today. Once Kepler himself accepted that the orbits of planets were not - the perfect circles - as stipulated by Aristotle - but rather elliptical orbits, he set about formulating his - Laws of Planetary Motion - as follows.

First Law: The orbits of the planets are ellipses - with the Sun at one focus of the ellipse.

Second Law: Using orbital geometry demonstrates how a planet moves faster as it nears the Sun - at its perihelion and slows at its furthest point - the aphelion.

Third Law: Circumventing the mathematics - the Third Law demands that the time for a planet to orbit the Sun increases rapidly with the radius of its orbit. For example Mercury, the closest planet to the Sun, takes a mere 88 Earth days to orbit the Sun. Conversely, the outermost dwarf planet - Pluto - takes 248 Earth years to complete its orbit.

In considering what we have so far covered, one perhaps gets a sense of disquiet regarding the Laws of Thermodynamics, and where they fit in? Is it then possible that in the emptiness of space, perpetual motion occurs quite naturally? Anyone who has read Bryan Gaensler's book, Extreme Cosmos - will be acutely aware of the sorts of speeds that have been maintained, even in our own solar system over many millions of years. Our Earth, he reflects, orbits the Sun at a dizzying 107,000 km/h. If you think that's fast, consider our innermost planet, Mercury, which maintains a speed of 170,000 km/h; and this has been going on unimpeded for nearly 5 billion years!

Not everything in our own solar system spins in exactly the same way of course; take the Sun for instance. Because the Sun is made up of gas it actually rotates faster at its equator than it does at its poles; to rotate fully at its poles takes 34 days - whilst a full rotation on the Sun's equator takes about 26 days (see - differential rotation). The Sun's equatorial velocity incidentally is 7,189 km/h. Whilst all this whirling is taking place, the Sun and its accompanying planets are of course all on another journey, around the galaxy. This journey, takes a Cosmic Year, and proceeds at a speed of 220 km/s. Our full galactic orbit - a Cosmic Year - takes between 225-250 million Earth years to complete! This means that during the past 5 billion years, our solar system has orbited the galaxy little more than 20 times!

Meanwhile, the whole Milky Way Galaxy hurtles through space at an estimated 600 km/s. If those few facts haven't made your head spin, consider this - the Sun, is an almost perfect sphere. Its motion as the centre of mass of the solar system is complicated by the gravitational influences of its orbiting planets. Every few hundred years the Sun's spin changes between prograde and retrograde. In other words, the Sun spins in the same direction as its companion planets for a few hundred years, but will eventually end up spinning in the completely opposite direction. Currently, the Sun, when viewed from the north, is rotating in a counter clockwise direction. This is the same direction as the planets rotate - and orbit around the Sun. Finally, the Sun's magnetic north pole - flipped from its northern hemisphere in February 2001 - and now points south! This situation is expected to reverse again during 2012. We are currently going through a period of quite extreme solar activity; just ask anyone who tries listening to digital radio.

To be continued...

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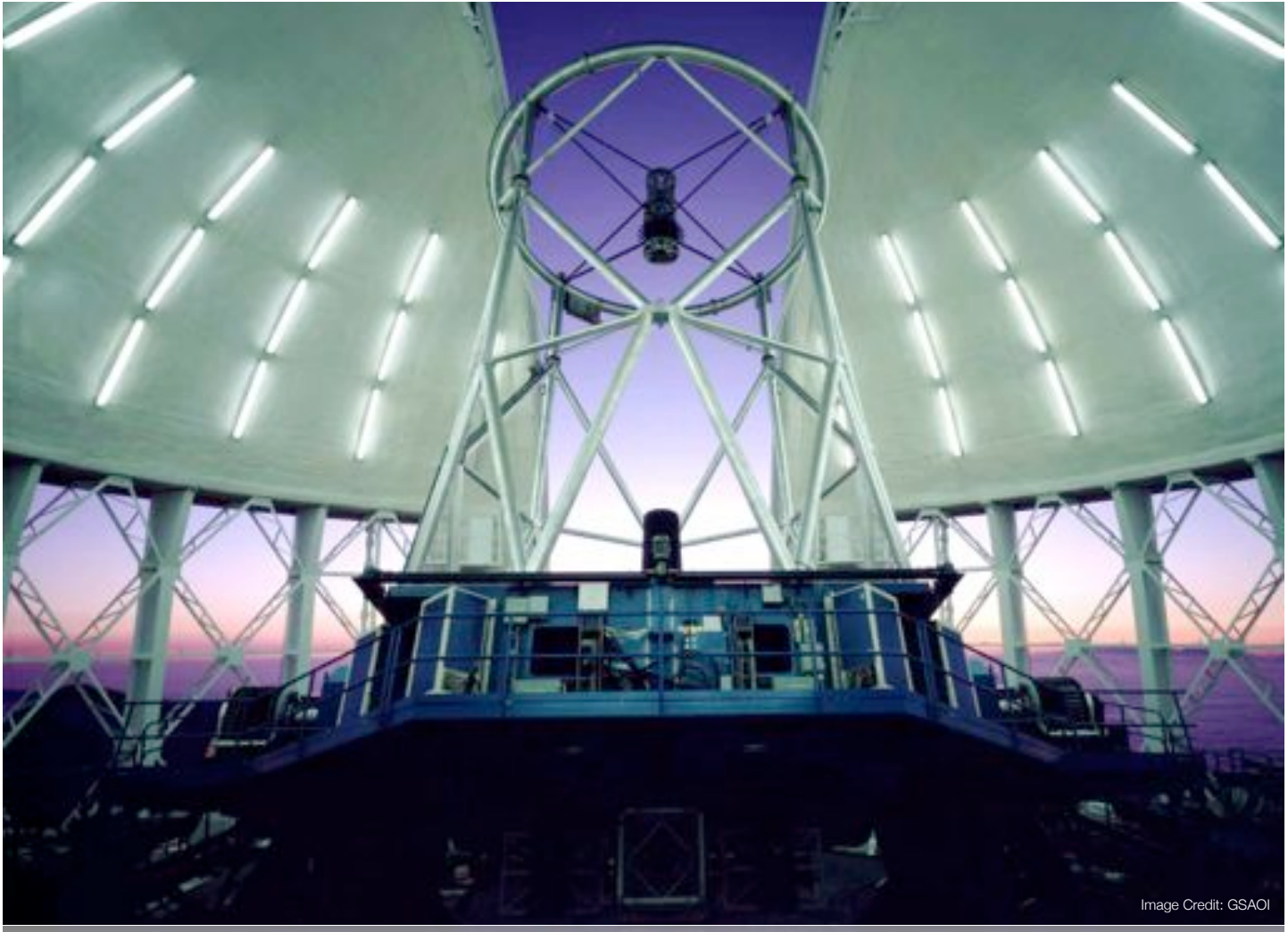


Image Credit: GSAOI

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

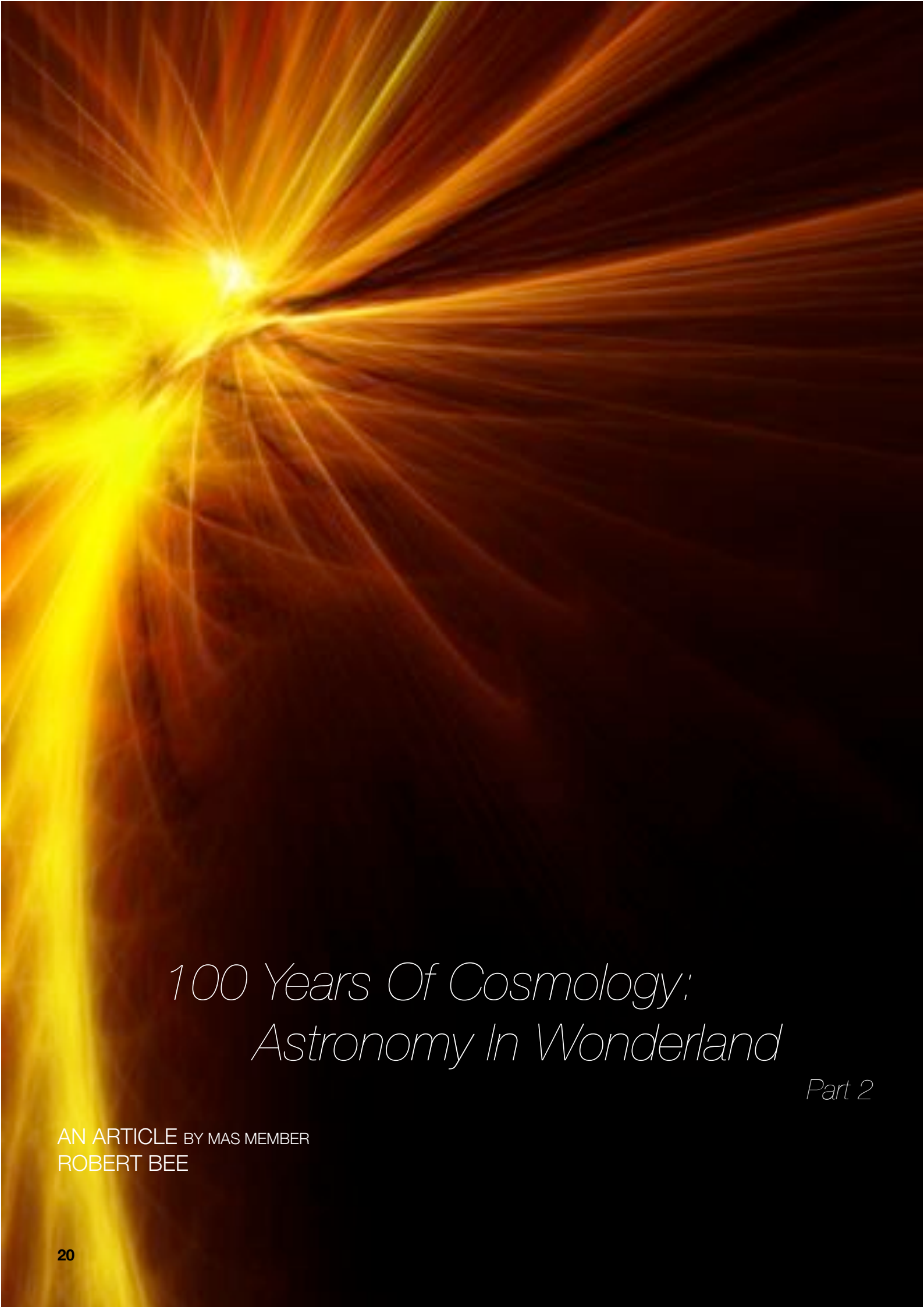
Depart: Honolulu Friday 14th September 12.45 (or your own itinerary from here)

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 2

AN ARTICLE BY MAS MEMBER
ROBERT BEE

100 YEARS IN COSMOLOGY

"ASTRONOMY IN WONDERLAND - CURIOUSER AND CURIOUSER" Part 2

(By Bob Bee)

In 1917, Einstein published his now famous Theory of General Relativity which was ultimately a theory about gravity and its impact on space-time. 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.

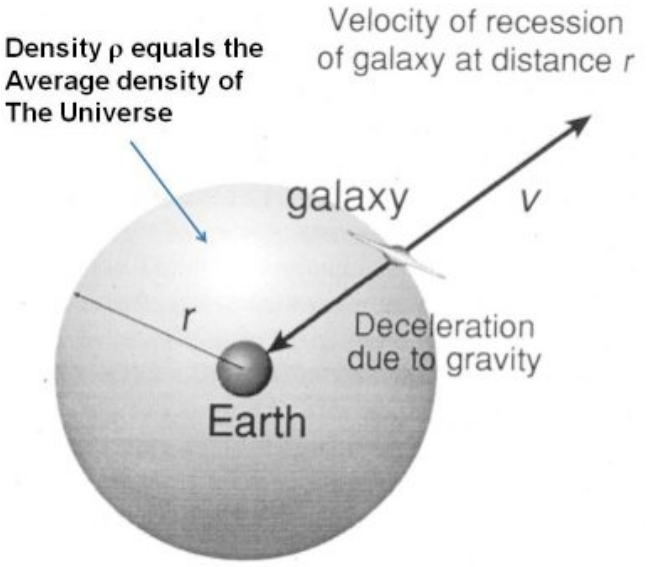
The Friedman Models.

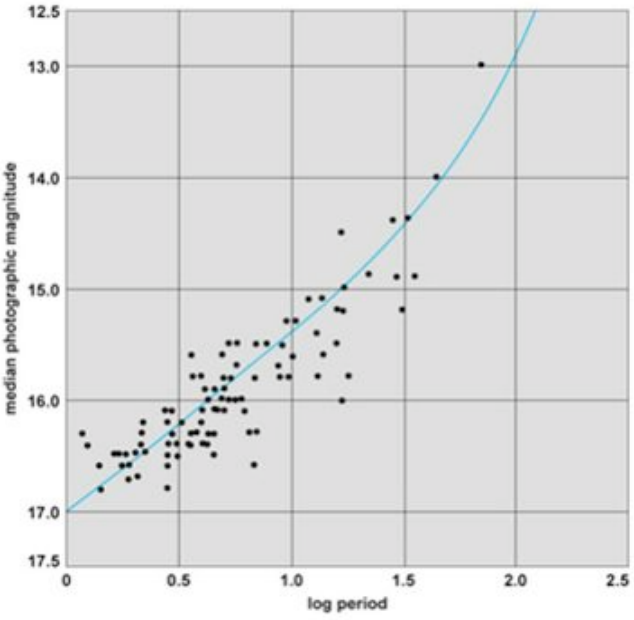
General solutions for the dynamics of expanding universe models of General Relativity were discovered by the **Russian Alexander Friedman** in the years 1922 to 1924.

Friedman's solutions were derived as a 'simplification' of the Friedman-Lemaître-Robertson-Walker (FLRW) metric which was a quantum level higher in complexity. If you want to see horrendously complex mathematics that beggars your senses, google FLRW etc and stand back. Friedman's simplified model (even its simplified mathematics is daunting for mere mortals) enables us to at least grasp a concept of the issue at play with the expanding universe.

The Friedman equations start with the simplifying assumption that the universe is spatially homogeneous (uniform density) and isotropic (appears the same in all directions). This is known as the Cosmological Principle. While obviously not applicable to our local region of the universe, it is justified on scales larger than ~100 Mpc as the 2dF and Sloane galaxy surveys show us. That is, it is a fair representation of the universe on a large scale.

What they basically tell us is how the rate of expansion of the universe changes with time. Keep in mind this was all theoretical as at that time it was thought the universe was static, with no expansion or contraction. The Friedman model describes a competition between the uniform expansion of the universe and the force of gravity to prevent this from happening. Now with the field equations of general relativity, this is hugely complicated. But, happily, it turns out that when solved and simplified, they equate to a very simple Newtonian physics model which our minds can grasp, as shown in the following diagram:





This model translates neatly into the question: “What is the deceleration due to gravity of a galaxy located at the surface of a uniformly expanding sphere which has a density equal to the average density of the universe?” The average density of the universe is called ρ (rho).

Solutions to this question produced three Friedman models, for three different values of Density Parameter.

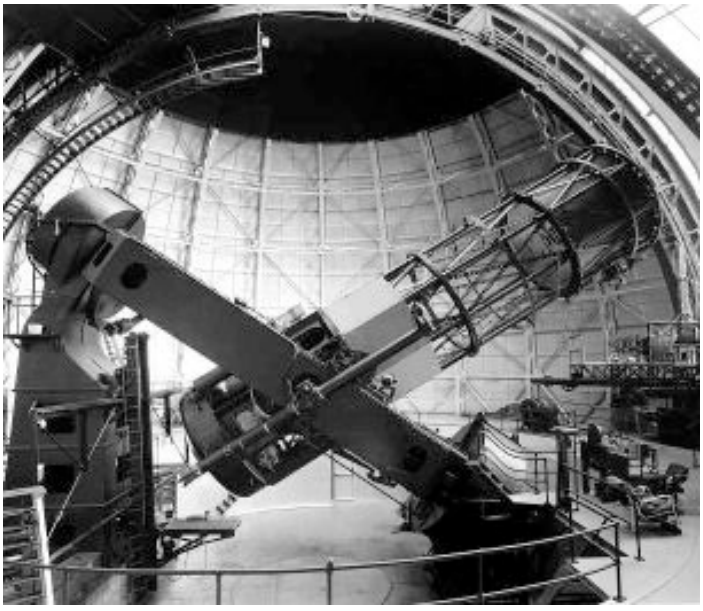
If we call Ω (**the Density Parameter) =** ρ/ρ_{crit}, where ρ_{crit} = the average density that gives a value of $\Omega = 1$ (called the Critical Density), then for:

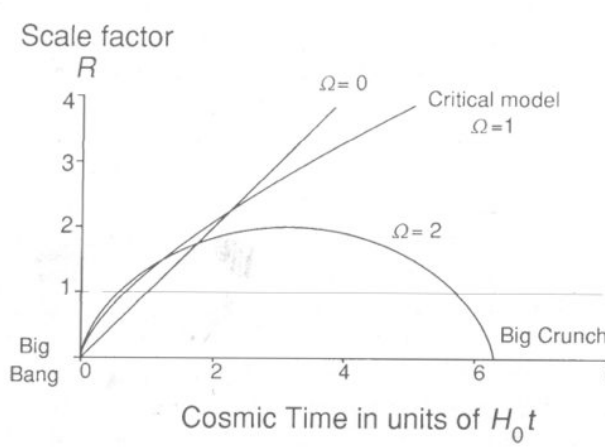
Ω **> 1** (that is the universe has a high density, greater than the critical density), the gravitational deceleration is high enough to halt the Universe’s expansion, causing it to reverse and collapse to a **Big Crunch**;

Ω **= 1,** the Universe expands to infinity, then stops (This is the *Einstein – de Sitter* model);

Ω **< 1** (that is the universe has a low density, less than the critical density), there is insufficient mass to prevent matter expanding to infinity and to keep going, never stopping.

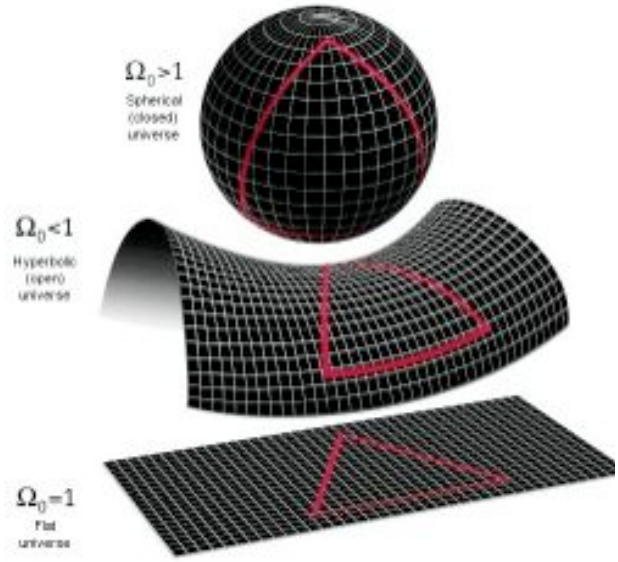
The three models are shown on the three curves in the following chart, with the spacial expansion of the universe (the Scale Factor) on the vertical axis and time moving to the right on the horizontal axis. The chart sets values of $\Omega = 2$ (which is > 1) and $\Omega = 0$ (an extreme example of $\Omega < 1$).





This model by Friedman would form the basis for future theories of a Big Bang. In fact, some argue that Friedman was the father of the Big Bang theory. More about that later on.

This concept of the Universe’s Density Parameter Ω will be very important later when we look more deeply into some other big cosmological questions, including the very shape of the universe. Is it ‘flat’, ‘spherical’ or ‘hyperbolic’? Do the angles of cosmic sized triangles add up to more, less or equal than 180°? The value of Ω has a direct influence on that, as shown here:



A measurement of the value of the universe’s density parameter Ω was to become another ‘holy grail’ for cosmologists.

Edwin Hubble and the expanding universe.

It was after this in 1924 that Edwin Hubble used the giant 100” Mount Wilson telescope to identify Cepheid Variable stars in the Andromeda ‘spiral nebula’ and calculate their distances. The earlier work of Henrietta Leavitt’s is finally utilised to great effect.

Hubble calculated that the Andromeda 'nebula' was over a million light years away, clearly outside our own and a galaxy in its own right. (Hubble got the distance wrong initially – from a calibration error of Cepheid brightness– but when corrected gave the distance of about 2 million light years. We now know it is further than that, around 2.5 million light years.)

This showed that those wispy 'spiral nebulae' were not solar systems in formation (as hinted by Slipher) or just gaseous clouds but immense stellar systems outside our own Milky Way. Thus the existence of remote galaxies, just like ours, was established.

The universe had experienced its first major paradigm shift. The Milky Way was no longer the whole Universe.

(Personal aside: It's difficult for some people now to imagine how huge a shift in thinking that would have been to astronomers of the time. Would it have been a similar shock to that experienced by 17th century astronomers realising, post-Copernicus and Kepler, that the Earth was not the centre of the universe as taught by Ptolemy's Almagest, but 'just' one of six planets orbiting the Sun?

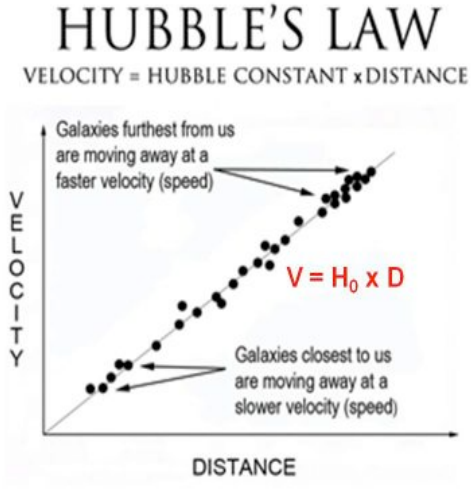
I remember while studying at Sydney University browsing through the 'stacks' at Fisher Library and finding a very old astronomy text, published ca 1920. I was taken aback when I saw B&W images of what I knew then in 1964 to be spiral galaxies but the book described as filmy nebulae, clearly within and part of the Milky Way. I had no idea until then that astronomers had once held that view.)

Hubble's 'discovery' should not have come as a total surprise to astronomers as this had been a subject of speculation and debate for quite some time. 18th and 19th century astronomers and philosophers had speculated about 'island universes' but there was no observational evidence so it remained speculation. It actually became a major controversy when on 26th April 1920 there occurred what is now call 'The Great Debate' between two astronomical heavyweights Harlow Shapley and Heber Curtis held in the Baird auditorium of the Smithsonian Museum of Natural History. The debate focused on two related questions: What is the physical size of the Milky Way ('The Galaxy')? and; Are the 'spiral nebulae' extragalactic systems or do they belong to the Milky Way? The debate did not resolve the issue. That was left to Hubble.

Hubble had applied himself to measuring the spectra of many distant galaxies (following the earlier work of Slipher and using some of his red shift data). He found that, apart from the obvious closer ones which were 'blue shifted' (moving towards us), all the others were red shifted, indicating they were receding from us.

By 1929**,** he had measured the red shifts and distances to a large sample of galaxies and got an amazing result. The more distant the galaxy, the greater the measured red shift and, therefore, the faster it was moving away from us. In fact, after doing what all scientists love to do – plot their data on a chart - he showed: **The speed away from us was directly proportional to its distance**.

This became known as **HUBBLE'S LAW**, and the constant $\mathbf{H_o}$ in the formula was called **Hubble's Constant.** (It has been suggested it was extremely immodest for Hubble to give the constant his own initial, H. However, in fairness he actually initially designated it with a 'K' for constant (he couldn't use 'C'). Somehow, it morphed to H and has stayed as such.)



An accurate measurement of the value of H_o has been **a Holy Grail** of cosmologists since then. The unit of H is **km/s/Mpc**. That is: kilometres per second per megaparsec, where a megaparsec is 3.26 million light years. Its measured value has gone up and down (in the early days due to uncertainties) from 100 to 50 km/s/Mpc but has settled down these days. The accepted current value of H_o is 72.0 km/s/mpc. It is important to remember, however, that that value is for H_o, the current value in our time for the nearby universe. This is important when we consider issues later in this article.

Hubble's data suggested something very special and a new idea: **The Universe was expanding.** That is, all the galaxies are receding from us, and the further away, the faster it is receding.

This was the next paradigm shift in cosmology. But it was not really such a new idea – Friedman had indicated its possibility in his General Relativity solutions and modelling in 1924 as we previously saw. Hubble's work effectively corroborated it with observational evidence.

A caution and explanation is necessary here. Some who hear about Hubble's discovery for the first time leap to the conclusion that all the galaxies are all racing away from our galaxy and therefore it must be at the centre of the universe. Nothing could be more incorrect. In fact, from any of the 100 billion odd galaxies in the universe, all the galaxies would be seen to be racing away from it. In that sense, everywhere is the centre of the universe. The fact is, the whole universe is expanding and all galaxies are moving away from each other at a speed proportional to their distance. Hubble's Law!

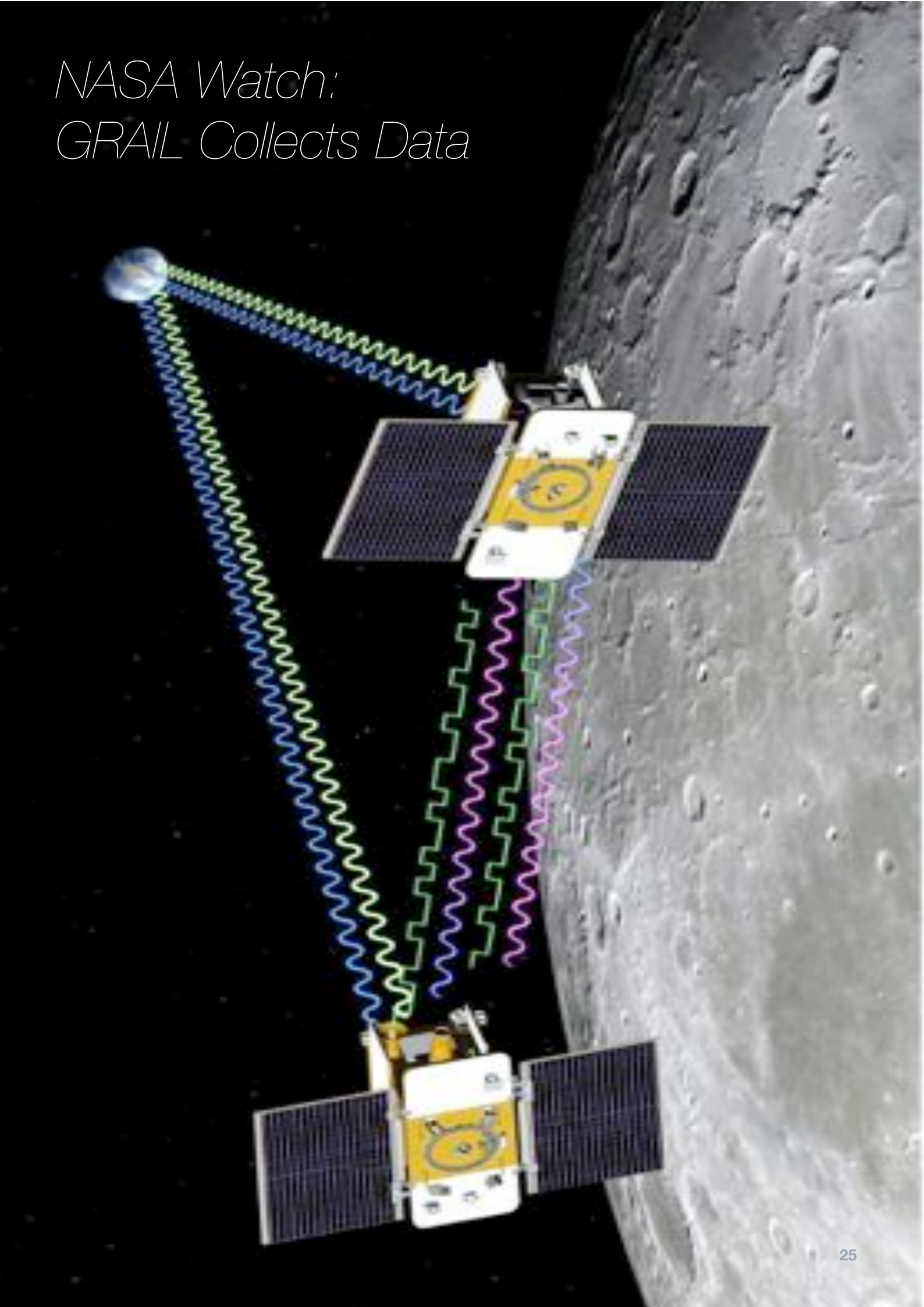
Although this discovery certainly brought light to the vast majority of astronomers and cosmologists in the world, it could be said it brought a sense of gloom to at least one person – the great Albert Einstein.

*****

END OF PART 2.

In Part 3 we will learn why Einstein was chagrined at Hubble's discovery and how he dealt with it, much to his later regret; how two completely different theories battled to explain the expanding universe; how a chance but epic discovery buried one of the theories, and; how measurements of the universe's Density Parameter started to cause cosmologists major headaches.

NASA Watch: GRAIL Collects Data



PASADENA, Calif. -- NASA's Gravity Recovery And Interior Laboratory (GRAIL) spacecraft orbiting the moon officially have begun their science collection phase.

During the next 84 days, scientists will obtain a high-resolution map of the lunar gravitational field to learn about the moon's internal structure and composition in unprecedented detail. The data also will provide a better understanding of how Earth and other rocky planets in the solar system formed and evolved.

"The initiation of science data collection is a time when the team lets out a collective sigh of relief because we are finally doing what we came to do," said Maria Zuber, principal investigator for the GRAIL mission at the Massachusetts Institute of Technology in Cambridge, "but it is also a time where we have to put the coffee pot on, roll up our sleeves and get to work."

The GRAIL mission's twin, washing-machine-sized spacecraft, named Ebb and Flow, entered lunar orbit on New Year's Eve and New Years Day. GRAIL's science phase began yesterday at 5:15 p.m. PST (8:15 p.m. EST). During this mission phase, the spacecraft will transmit radio signals precisely defining the rate of change of distance between the two. The distance between the spacecraft will change slightly as they fly over areas of greater and lesser gravity caused by visible features such as mountains, craters and masses hidden beneath the lunar surface. Science activities are expected to conclude on May 29, after GRAIL maps the gravity field of the moon three times.

"We are in a near-polar, near-circular orbit with an average altitude of about 34 miles (55 kilometers) right now," said David Lehman, GRAIL project manager from NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif. "During the science phase, our spacecraft will orbit the moon as high as 31 miles (51 kilometers) and as low as 10 miles (16 kilometers). They will get as close to each other as 40 miles (65 kilometers) and as far apart as 140 miles (225 kilometers)."

The two spacecraft were previously named GRAIL A and B. The names Ebb and Flow were the result of a nationwide student contest to choose new names for them. The winning entry was submitted by fourth graders from the Emily Dickinson Elementary School in Bozeman, Mont. Nearly 900 classrooms with more than 11,000 students from 45 states, Puerto Rico and the District of Columbia, participated in the contest.

JPL manages the GRAIL mission for NASA's Science Mission Directorate in Washington. The GRAIL mission is part of the Discovery Program managed at NASA's Marshall Space Flight Center in Huntsville, Ala. Lockheed Martin Space Systems in Denver built the spacecraft.

For more information about GRAIL, visit: http://www.nasa.gov/grail

"Sky Bikes"

A SHORT STORY BY MAS MEMBER
STUART CANT

Almost two centuries since the first rockets were launched into orbit, space travel was now fairly commonplace. Costs were greatly reduced by improved technology, but space exploration was still Very expensive. Consequently, spacecraft from Earth did not arrive very often, especially to the most distant scientific base on Saturn's largest moon, Titan, at the extreme edge of the Terrestrial Empire.

It was a cause for celebration when a supply spacecraft arrived with a shipment of machinery, spare parts, scientific instruments for new projects, and a scientist to work at 'the observatory. Her name was Melanie Doyle. She was to see the magnificent ringed planet in the blackness of space outside the viewport. She was disappointed that the famous _ rings were seen edge on and almost invisible, She had seen them in their full glory through a telescope on her way from Earth.

After the supply ship docked with the space station orbiting Titan, she searched around the sky to find planet Earth. It took her a few moments to find the faint bluish dot close to the sun in Taurus. Seeing her home world so tiny, so faint, so far away reminded her very forcefully how far she was from home. At this distance, even the Sun was a fraction of its size as seen from Earth, and was not much brighter than a full moon.

After a few hours at the orbiting station, she descended to the base on the surface of Titan.

I met her as soon as she came in through the airlock. "I am Daryl Sharpe. Would you like me to show you around the base?"

"Yes please," she replied

"There are only a few dozen of us on Titan. This is the only moon in the Solar System with a dense atmosphere. You can't breathe it though, there is no oxygen and it is a hundred degrees below freezing. That's why we live in this dome. It does not have to withstand pressure but it is needed to contain a breathable atmosphere, heated to a comfortable temperature. Titan's gravity is much weaker than Earth's so the dome can be built quite large without the need for heavy framework."

"Do you ever go outside?" Melanie asked me.

"Yes. Quite often. We are very strict about safety procedures and we have to get permission to go outside. We don't full spacesuits, but we have to wear and fully enclosed suits with heating elements. I'd be happy to take you out sightseeing. Are you free tomorrow?"

After getting approval to go outside, and to put on our protective suits, to ensure the oxygen tanks were full, and the batteries that powered the heating elements and radio were fully charged, we were on our way.

The methane clouds blocked what little sunlight there was, and nobody out on foot was allowed out of sight of the dome.

Back in the base, I was interested in Melanie's stories about her homeland on Earth. We spent long hours together when off duty talking about each others' worlds. There was much she needed to know in order to live on Titan, even for a short time. I found her very attractive and I decided I would like to get to know her better.

One day I introduced her to one of our favourite sports. I led her to a platform at the end of the arena.

"Here we are," I told her.

"What are they?" she enquired as she inspected the row of aircraft. They resembled large hang gliders. The pilot's seat was fastened by struts under the large umbrella-like wing, and the pilot's feet rested on pedals linked to the propeller.

"On Earth these machines could not fly." I told her. "The human body could not generate enough power to become airborne, but on Titan the gravity is only a fifth as strong as Earth's" I wheeled one of the aircraft out onto the platform, which was in the form of a runway about ten metres above the ground.

I put on a crash helmet and sat in the pilot's seat. I noticed Melanie standing too close to the edge, and warned her to be careful not to fall. "Even though Titan's gravity is much weaker than Earth's, you could still break your neck if you fell head first. Don't forget, falling from ten metres here would be equivalent to a two metre fall on Earth. A lot of people from Earth have had some very bad falls when they failed to realise that.

I turned the pedals as fast as I could, and when the propeller was spinning at maximum revolutions, I released the hand- brake and raced along the platform like a fighter plane taking off from an aircraft carrier. The dome was much larger than any enclosed space on Earth, which gave me sufficient room to maneuver the aircraft. I pedalled hard and gained height, and I circled around and landed on the platform as if I was landing on an aircraft carrier.

When I stepped out of the aircraft after it came to a stop, I told Melanie, "That would not have been possible on Earth, be- cause of its stronger gravity, but in Titan's much weaker gravity, it is easy to gain height and make turns."

"Can I have a go?" Melanie asked.

"No, not until you have had instruction and passed tests. They are stable and easy to fly, but tricky for a beginner to handle." I told her. "I'll meet you down on

the ground," I added as I put my helmet back on and sat down on the pilot's seat. I revved up the propeller and took off again. I immediately turned and landed on the ground under the platform. "Come on down," I called out to her.

She quickly descended the ladder, and when she was standing beside me, I remarked that some of us could jump from that plat- form. "From ten metres?" she asked incredulously.

"But in this weaker gravity, that's equivalent to only two metres on Earth. Don't you try it though. You could break your neck if you come down head first. Your co-ordination and re- flexes would be all wrong. Even people who have been here for years are discouraged from doing it."

I invited Melanie to sit in the pilot's seat, and told her to give the pedals a few turns. When she had got the feel of it I asked her to taxi along the ground. "Not too fast," I reminded her. "Don't take off until you know how to control it."

After a few days of instruction she understood the theory of turning and how to gain and lose height. At first she was unsteady in the air, but soon learned to fly straight and lev- el and to turn easily. After more than two centuries of aero- planes controlled by computers and hydraulic and electronic systems, it was unusual to get back to the principles of the first generation of flight and just fly by the "seat of your pants". Her first landing was bumpy but she improved with practice.

When she was able to fly with confidence, we flew side by side in two pedal-powered planes, and as her skill improved further we challenged each other to races. Soon she was doing well against other pilots and losing by surprisingly small margins, even winning some races.

"If the bases on Earth's moon were big enough, you could fly pedal-powered planes there too, its gravity is roughly the same as Titan's, but very large domes could not resist the air pressure inside when there is hard vacuum outside." I told her.

One day I asked her if she would like to fly outside.

"I didn't know you could take these machines outside," she replied.

"Not these ones. We have bigger two-seat aircraft made of materials that can withstand the freezing temperatures and the chemicals in the atmosphere." While we were suiting up to go outside, I explained to her that the aircraft that fly outside have to be heavier and more robust, and consequently needed two people to power them.

"These aircraft are only for recreation," I pointed out to her, "For working outside we have powered aircraft and ground vehicles."

Melanie was very intrigued to see the base with its huge dome from above. "What's that flame coming out of that tower?" she asked me.

"That's excess oxygen being vented away. Our life support module generates our oxygen and water, and the excess allowed to escape into the atmosphere., which being largely methane, is burned off, like waste gas on oil wells." I circled around the base to give her a closer look. "Our vehicles that travel outside the base use the methane for fuel and carry oxygen," I explained. "At the low temperatures on Titan it is easy to keep the oxygen liquid in its tank."

"The opposite way around from vehicles on Earth," she commented, "oxygen from the air and carry fuel."

I then turned the aircraft away from the base. "Let me take you sightseeing," I said.

She was fascinated by the surreal landscape I showed her in the dim lights. The huge boulders of water-ice and rock covered by strange chemicals, volcanoes erupting liquid water, lakes of liquid methane with icebergs of frozen ammonia, and many wonders too strange for her to understand.

I could hear her breathing heavily from the exertion of pedalling.

"I'm getting tired," she complained.

"Keep pedalling," I urged her, "I can't maintain height by myself."

"Can we land and rest for a while?"

"I'm afraid not, there's nowhere we can land safely".

"Take me back to the base then please, I keep this up much longer."

"Okay then," I agreed and turned the aircraft back to base.

When we were nearly home, Melanie noticed that the flame from the oxygen vent was not burning. "That happens a lot," I told her when we had landed. "It is very difficult to keep it burning in this freezing temperature."

Back inside when we were taking off our protective suits, she commented on the overpowering stink that followed us in the airlock.

"There's not much we can do about that," I said, "We pump the air in the airlock back outside, and any that gets in on our clothes gets processed by the life-support machinery."

"Smells like a very deadly fart," she giggled.

I offered to show her around the life-support section. I explained to her how everything is recycled to create

the water to drink, the food to eat, even the air to breathe. "One day the air outside will be breathable, and all we'll need outside will be those heated suits," I said hopefully.

"How long will that take?"

"A very long time, years probably."

In the meantime, excess oxygen slowly vented outside and bunt off in the methane-rich atmosphere. All too often the flame went out in the extreme cold.

Inside, the temperature was comfortable, and the air breathable. We often went flying in our pedal-powered hang-gliders. When not in the air, we walked hand-in-hand around the colony.

"If we were back on Earth," I whispered to her one day, "We could get married, but there are no civil marriage celebrants or churches on Titan, so you'll just have to move in with me without any ceremony."

The only ceremony was to seal the deal with a kiss. Even though there was no real wedding, it was still an excuse for a party.

Very slowly, oxygen built up in the atmosphere, but not enough to be breathable even when our daughter was born a year later.

In the colony of only a few dozen people, where everyone knew everyone else, we were like a single extended family so it was easy to find somebody to babysit little Jacqueline when we went flying or when Melanie was on duty at the observatory.

As always, a wave of euphoria swept through the colony when the word went around that a spacecraft from Earth was due to arrive in two weeks.

By now Jacqueline was walking, and our second child was due in seven months.

Slowly, the oxygen was accumulating in the atmosphere, and the winds scattered it all around Titan. While the visitors were in the colony, we overwhelmed them with our partying. Many became involved in passionate affairs with Titanians. This was not frowned on at all; on the contrary, falling pregnant to a visitor from Earth was the only way to avoid in-breeding. The visiting engineers and scientists made their reports on the progress of the colony. All too soon it was time for the Earthlings to depart. Some of the locals wept as their temporary lovers boarded the rocket and lifted off. Gloria was very sad to see her lover leave, having discovered only the previous day that she was pregnant.

What happened next was greeted with stunned shock. When the rocket was about a thousand metres up, the air around it burst into flames. A blue and yellow flash zoomed across the sky. In seconds the whole sky was ablaze. Suddenly the rocket's fuel tanks exploded. Wreckage rained down over a wide area. We were too stunned to say anything. Gloria was in shock to see the disaster involving the father of her baby.

It took us a few hours to work out what happened. For years, the concentration of oxygen in the atmosphere had been slowly increasing until it had almost reached saturation point. Normally the winds would have whisked it away until it was too dilute to ignite.

Today, when the wind was calmer than usual, a layer of oxygen had accumulated and the hot exhaust of the rocket ignited the highly inflammable methane-rich atmosphere, and swept like lightning around Titan.

ESO Watch: New "Thin" Mirror For VLT

A remarkable thin-shell mirror for ESO's Very Large Telescope has been delivered by the French company SAGEM. It is 1120 millimetres across but just 2 millimetres thick, making this mirror much thinner than most glass windows. This mirror has to be thin enough to act almost like a flexible film. When installed in the telescope the shape of its reflective surface will be constantly changed by tiny amounts to correct for the blurring effects of the Earth's atmosphere and create much sharper images.

The shell mirror is a sheet of ceramic material that has been polished to a very accurate shape. The manufacturing process starts with a block of Zerodur ceramic, provided by Schott Glass (Germany) that is more than 70 millimetres thick. Most of this material is ground away to create the final thin shell. The challenge is to apply very little pressure and low levels of stress to the glass throughout the manufacturing process.

Making and testing such a large but flexible mirror is a huge challenge, but SAGEM has succeeded by carefully controlling the risks of the manufacturing process and has delivered a thin shell that satisfies ESO's requirements.

The new mirror is a major component of the deformable secondary mirror that will replace the current secondary in one of the VLT's four Unit Telescopes. This forms part of the new Adaptive Optics Facility for the VLT. The entire secondary is built around a rigid "reference body" and includes a set of 1170 actuators that apply a force on 1170 magnets glued to the back face of the thin shell. The shape of the reflecting surface of the thin-shell mirror will be deformed up to a thousand times per second by the action of these actuators to correct for the effects of turbulence in the Earth's atmosphere and deliver much improved and sharper images.

The Adaptive Optics Facility will also make use of laser guide star technology that is being developed in parallel.

Since 2004, ESO, with the help of the European Commission, has been financing efforts to develop the know-how for the manufacture of thin-shell mirrors in Europe. ESO is delighted to see these efforts bear fruit, thanks to the competence and determination of SAGEM.

The new thin-shell mirror, and the adaptive optics system that it forms part of, is paving the way for ESO's next project: the European Extremely Large Telescope (E-ELT). This work is driving forward progress on advanced technologies such as deformable mirrors with a large number of actuators and the manufacture of thin-shell mirrors. These technologies are directly applicable to the huge 40-metre-class future telescope and the E-ELT design already includes a 2.4-metre thin-shell deformable mirror largely inspired by the Adaptive Optics Facility deformable mirror.

eso.org

ImageCredit: ESO

Point Hicks Lighthouse - Barry Moore

Cows & telescopes: Tidbinbilla - Bruce Reardon

Venus & Jupiter - Roger Powell

Musings

Ursula Braatz

Venus slowdown has astronomers in a spin.

I found on ABC Science this article. Venus now takes six and a half minutes longer to complete a full rotation than it did 16 years ago. It is an unexpected result. That makes me think, could this happened to Earth? Venus is different, and they don't know if it has a solid or liquid core, which will help in understanding the planet's creation and evolution.

I think that the scientists don't know if Venus was faster 1000 or more years ago. Venus is hot and we can't live on it and Earth has the right temperature for life and seems to be stable. But we really don't know if Earth will go slower in 10000 or more years. If human beings are still here, they have to change the calendar...

Steamy water-world gets the Hubble treatment.

This article is from Astronomy Now Online. Hubble Space Telescope observations of a 7 Earth-mass planet find an unusually water-rich world swathed in a thick steamy atmosphere. GJ1214b circles its star at a distance of two million km. Its temperature is approximately 230 degrees Celsius.

When GJ1214b started its life, it was further away from its star. There must have been plentiful ice in the outer reaches. On a path toward the star, maybe it passed through the habitable zone and the surface temperature became like that on Earth. More observations should give a clearer picture of what is going on in GJ1214b atmosphere. Was there life on this extrasolar planet?

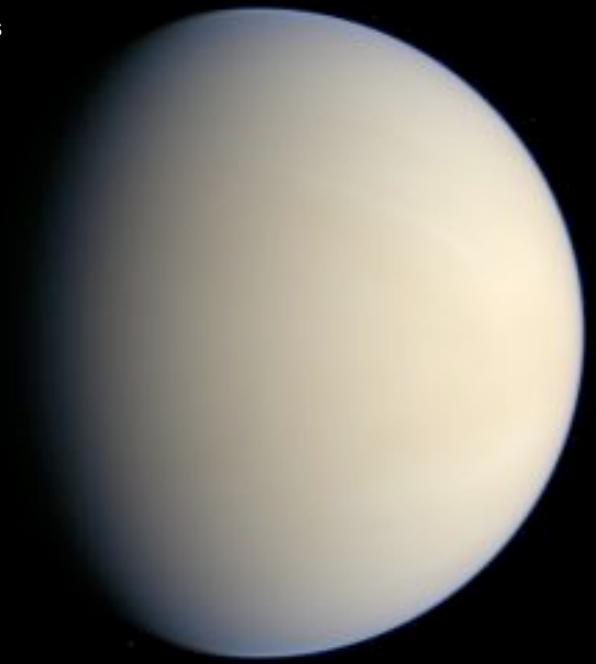


Image Credit: NASA

macarthur astronomy forum

M.A.S. Forum - March

A big MAS welcome this month to Les Dalrymple, a contributing editor for **Australian Sky and Telescope Magazine**. Les is also a member of Sutherland Astronomical Society and a guide lecturer at the **Sydney Observatory**.

Members will recall Les's last visit when he gave an inspirational talk about globular clusters.

Titled **"*The Evolution of M83 and the Centaurus Galaxy Cluster*"**, Les will be discussing the observational history and present state of knowledge as it relates to the major members of this cluster of galaxies.

MAS Shop

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!

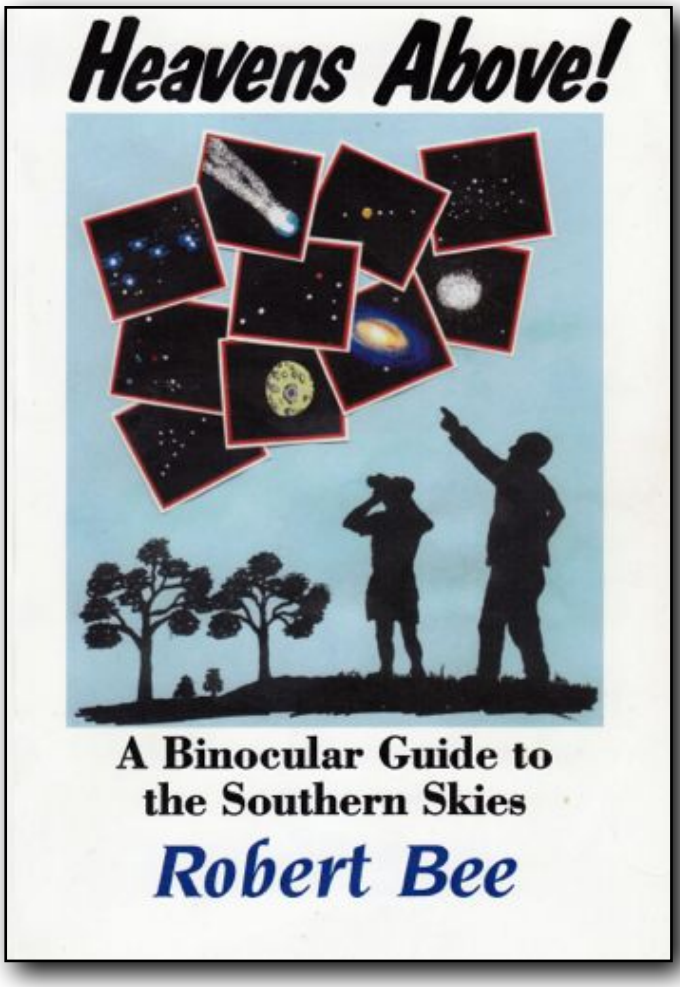
Advertisement

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 !!!