PRIME FOCUS

MAS SOCIETY JOURNAL

macarthur astronomical society

Apr 2012

volume 17 issue 4

Prolific Australian astrophotographer Jeanette Dunphy, from Queensland, visiting MAS at the Forest

Image Credit: Chris Malikoff

macarthur astronomical society

Sat 7th to Sun 8th July 2012

campbelltown city council & macarthur astronomical society co-present...

magnitude II

skies over macarthur

astrophotography exhibition

Image Credit: Humayun Qureshi

campbelltown city council

Campbelltown Arts Centre
Art Gallery Road, Corner Camden and Appin Roads
CAMPBELLTOWN
Sydney, NSW 2560
AUSTRALIA

www.macastro.org.au

From the Editor's Desk

Welcome to the April 2012 edition of Prime Focus - "volume 17, edition 4".

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 April 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**. File sizes can reach 35Mb+.

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 April AGM edition - our fourth for the year 2012.

Our "Page 3" feature will be back for the May issue… Ed

Clear Skies!
Chris Malikoff

Contents

president's **report**

TREVOR RHODES

Hello Members.

This is my very last President's Report. I will leave all the thanking the Committee to the Annual Report and not duplicate that here. They know I love them all. :)

It has been a year of highs with all the great Guest Speakers we've had and lows with the bad weather we have had to endure. The start of negotiations regarding "**m a g n i t u d e II**" and Dharawal also make the future for MAS look quite positive.

I will be keeping the mid week Stargard sessions going this year to help fill the hole we inevitably feel when bad weather creeps in on us. Please let me know if midweek appeals to you. The upcoming Globular Cluster Marathon is another event in which I hope many will participate this year.

One thought I would like to leave you all with is that the Committee you choose for the next year have a lot of work to do. I know that most people are not cut out for committee work and that is fine. What we do need though, is for you, the members to come forward and help out when you can. There are Public Nights, School Nights, Stalls, Magnitude etc, where the committee would appreciate your time. A couple of hours here and there make a big difference. So please, speak to a committee member and let them know you are willing to help out.

As usual, I'm 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.

secretary's column

ROGER POWELL

I introduced this column, shortly after becoming Secretary in 2008, to communicate the activities and decisions of the Committee to the membership. I hope I have achieved that aim adequately since then.

For my forty-second and final column, I am going to firstly mention the committee members I have worked with for the last four years and then review the achievements of the Management Committee during this period. I will sign off with my hopes for the future.

I have admired the contribution of both the Presidents I have worked with. Trevor Rhodes has been President for the last year and he has managed the Society's affairs with great distinction, using his wealth of experience gained from holding office in other community groups. I will be very sorry to see Trevor step down this month.

John Rombi was President prior to Trevor and he is still making a great contribution as "*Head of the MAS Guest Speaker Arm-twisting and Procurement Unit*."

Vice-Presidents have been Daniel Ross, Trevor Rhodes and most recently, Chris Malikoff. I hope to see Daniel back on the committee one day. Chris's innovative business and technical skills have been directly responsible for many of the improvements at MAS over recent years, including the current website and the transformation of Prime Focus magazine to a new format in colour.

Dick Everett was Treasurer for six years before Tony Law took over and is one of the Society's most experienced "Astro-Elders", whose advice is still sought and appreciated by the Committee. Tony has expertly administered the finances for the last three years and has been heavily involved in all of the MAS projects during that time. In particular, Tony persuaded the Committee that it needed to focus on conserving it's finances and building them up, in order to look towards the future development of MAS with confidence.

Stewart Grainger joined the Committee at the same time as I did and has worked diligently to successfully build up the merchandise side of our activities. It is good news for MAS that Stewart is continuing.

Lloyd Wright, Carol McVeigh and Ivan Fox have filled the other committee member positions during that period and have all been a pleasure to work with. Carol's business skills have been invaluable and I hope that she will return to the Committee in some capacity one day. Lloyd has just completed ten years on the committee!

Prime Focus has been extremely well served by Editors Kate Ross, Geoff Young and Chris Malikoff, all of whom took on the very difficult task of producing the Society's journal and the even harder task of persuading members to contribute to it!

Others I want to mention are the stalwarts who built up this great Society - before I even got around to joining the Committee - such as our founding President and honourary member, Phillip Ainsworth, his successor as President, Noel Sharpe (who still does certain jobs on behalf of the Committee) and Ian Cook, another of the Society's "Elders".

Others who have taken on jobs include Ned Pastor and our Auditor, Graeme Bellamy. Bob Bee was Editor of Prime Focus for eleven years and recently completed fourteen years of fortnightly astronomy columns in the Macarthur Chronicle. He also promotes MAS with his regular speaking engagements around town. The position of "Meeting Night Catering Manager" has been filled by several members, including Debra Taylor, Barry Moore and more recently by Carol McVeigh. A new volunteer is being sought this task.

The Society is indebted to you all. This is a wonderful, friendly Society with members drawn mainly from the Macarthur Region but we are also very proud to have members from as far afield as Wollongong, Western Sydney, Northern Sydney, Orange, Canberra and Port Macquarie. You are all a great bunch of people and I have enjoyed being your Secretary for four years. It has been a pleasure to watch the growth in telescope expertise; the improvement in astro-imaging; and the the steady growth of telescope aperture amongst our members telescopes.

This is a round-up of some of the issues and activities that the Committee has collectively dealt with over the last four years:

Schedule Planner

April 2012

14/4/2012
Stargard

16/4/2012
Annual General Meeting
Macarthur Astro Forum

20/3/2012
The Forest (Fri night)

21/3/2012
The Forest (Sat night)

22/3/2012
The Forest (Sun night)

28/3/2012
Public Night
Dudley Chesham Oval

The new NSW laser pointer legislation resulted in us adopting our own laser policy; introducing membership cards; and registering MAS with the NSW Police Firearms Registry.

The Constitution and By-laws have been modernised, making them more relevant to our current needs.

To engage more with the community the Committee re-badged our General Meetings as 'Macarthur Astronomy Forum'; made a greater effort to hold more public nights and school events, including a year of activities in support of IYA 2009; branded our public outreach events as 'Magnitude'; introduced publicity logos; held a very successful photographic exhibition at the Campbelltown Arts Centre; introduced an MAS Facebook page; created a SkyNet team; introduced a “Members Image Of the Week”; and created MAS and Macarthur Astronomy Forum pages on Wikipedia.

To improve the profile of the Society locally, the Committee entered into a dialogue with State & Federal MPs of both parties; and with different Mayors of Campbelltown; maintained a dialogue with UWS; setup a Facebook page; and put out streams of public statements which are regularly featured in the local media, especially The Chronicle.

For the benefit of members, the Committee sanctioned an amazing website (created by Chris Malikoff), with it's own web-forum, personal messaging facility and other features; re-introduced monthly e-mails to all members; revamped Prime Focus into a glossy colour magazine; organised coach tours to major telescope facilities; created a Merchandise Division with a web shop selling books, badges, mugs and more; published the Magnitude range of DVDs of members photographic images; and introduced five and fifteen year membership awards to supplement the existing ten year badges; and the monthly *Forest Nights* have become monthly *Forest Weekends*.

CONTINUED...

The Committee has brought some fabulous guest speakers of world-renown to the Macarthur Astronomy Forum, one of whom (Prof. Bryan Gaensler) is now our Patron; and thanks to John Rombi who has recently announced that Nobel Laureate Professor Brian Schmidt has agreed to address the Forum next year. Seeing the need to look after our VIP guest speakers more & and with a view to developing stronger ties between them and MAS - the Committee began regularly taken guest speakers to dinner before each meeting.

On the fund-raising side, the Committee has commenced holding sausage sizzles at Bunnings; initiated a sponsorship and advertising scheme. It has set up a PayPal account and (last but not least) the MAS bank balance has tripled.

Our membership has grown considerably and stabilised at around the ninety plus mark. With a more solid income base, the Committee has been able to invest in financial growth, with a view to achieving aims which some of us may have previously thought impossible. We should be positive and resolute about these aims for the Society, because other like-minded Society's in NSW have already achieved the goal that we are now seeking - our own observatory. We have begun discussions on conceptual design and we need to have a dream to pursue and a purpose for building up our funds.

To my fellow committee members, I thank you all for your friendship and hard work. To those who will be serving on the 2012-13 Management Committee, I wish you well and offer my support.

Over and out.

Roger Powell
Founding member.

speaker watch

ROGER POWELL

Guest speaker at the Macarthur Astronomy Forum in March was Les Dalrymple, a contributing editor for Australian Sky and Telescope magazine, a former President of Sutherland Astronomical Society and a guide lecturer at the Sydney Observatory.

Following his visit to MAS last year, when he gave an inspirational talk about globular clusters, there was a consensus amongst many members that we should invite Les back. Les has an encyclopaedic knowledge of astronomy and is currently doing a degree course in astronomy at Swinburne University. I wonder what the professors make of him, as he almost certainly knows more about observational astronomy than they do!

Les gave us a pretty fast-moving presentation about "*The observational history and present state of knowledge as it relates to the major members of the Centaurus A/M83 cluster of galaxies"*. Les informed us that this cluster is the second closest galaxy cluster outside our Local Group, the closest being the Sculptor Group.

The cluster is located mainly in Hydra & Centaurus and is believed to be approximately 20 million light years distant - although some reports put it at only 12-14 million. It is bigger than the Local Group and contains seven times the mass of the Milky Way. It contains one giant lenticular galaxy (Centaurus A), three giant spiral galaxies, two medium spiral galaxies and the rest are mainly dwarf galaxies.

NGC 4945 (in Centaurus) is an edge-on spiral galaxy, discovered by James Dunlop at Parramatta, with star-burst activity and a Seyfert nucleus emitting the spectral emissions of highly ionised gas. Jets have been observed at x-ray wavelengths, evidence of a black hole at it's centre.

M83 (Hydra) is the third most massive galaxy in the group. It is also a star-burst galaxy, which means it is undergoing an unsustainably high rate of star formation (possibly due to a recent galactic collision). It has forty-five massive star clusters within four hundred light years of it's centre. It also has a high population of Wolf-Rayet stars, possibly around two thousand. (The Milky Way has less than five hundred of these objects, which are hot, high mass stars rapidly shedding material). Multiple stacked images by David Malin show diffuse galactic arms extending well outside the normally perceived limits of the galaxy.

NGC 5253 (Centaurus) is an irregular galaxy similar in size to our own LMC. It is believed to have had a recent encounter with M83 and is a star-burst galaxy.

NGC 5068 (Virgo) is a mid-sized face-on barred spiral resembling the Milky Way.

NGC 5102 (Centaurus) is a peculiar galaxy, the second closest lenticular galaxy to us, consisting of a high population of very young stars. It's deficit of globular clusters is attributed to interactions with larger galaxies.

ESO 274-1 (Lupus) is a faint and obscure edge-on galaxy, barely visible in a 300mm telescope. It is twelve arc-minutes long.

The Circinus Galaxy (Circinus) is a massive galaxy in the galactic plane, discovered by the UK Schmidt telescope at the AAO. It is difficult to observe - due to it's location in the Milky Way - but not impossible. It also has a Seyfert 2 type nucleus and x-ray jets.

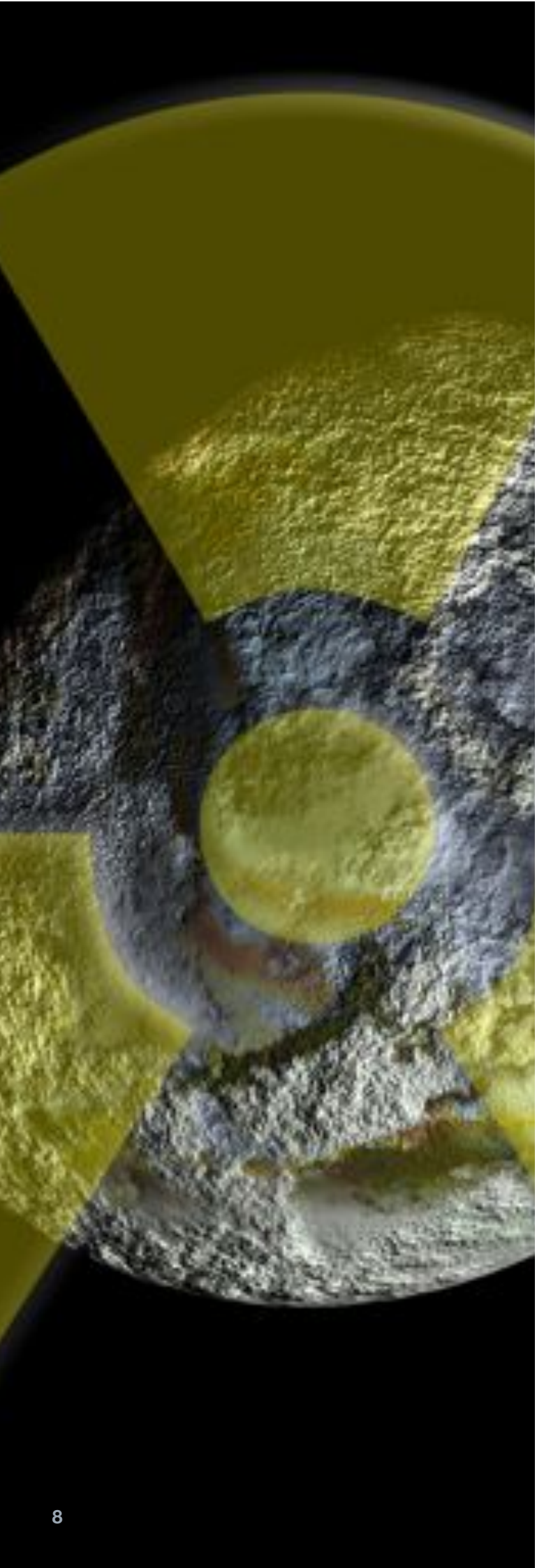
Centaurus A (NGC 5128) is well known to amateur astronomers in the Southern Hemisphere as a favourite target and is probably the most distant galaxy visible to the naked eye. It also was discovered by Dunlop at Parramatta and is a peculiar galaxy with high radio emission. It is the most massive galaxy in the group, containing a whopping sixty per cent of the mass. It's small nucleus is Seyfert and it's huge dark dust band may be the result of a galactic merger in process.

ESO 270-17 is a *shredded* galaxy close to Centaurus A and is slightly larger than our own LMC.

NGC 5237 (Centaurus) is a small dwarf galaxy close to Centaurus A and is probably two galaxies in the same line of sight.

All in all, this was a great talk by Les Dalrymple, an amateur astronomer with a deservedly high reputation for topic accuracy. It should inspire further research by members and maybe an effort by our observers to view some of the objects which form the Centaurus A /M83 Group. Who will be the first MAS observer to spot the elusive Circinus galaxy?

Logged in members can listed to a streamed audio recording of Les Dalrymple's presentation under the "Members" menu in a sub-menu titled "MAS Forum - Audio".



"THREE WISHES FOR TOMORROW"

PART3

(The final part of a short story by Robert Bee - continued from the March edition of Prime Focus)

~~~

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

Billton's eyes widened. He felt a sudden tightening of his chest. "Who do you think you are? God? You're playing with a fundamental process of nature." He had a frightening vision of a fusionless world, clean energy gone for good. Then his brain clicked forward one frame. Star Endeavour. His dream, his life's work. Useless. "Damn you… you can't."

"Can't I?" McWhirter snarled. "Watch me." He turned to the watching giant. "Genie. This is my wish. I wish that..."

"Crocodile. In humanity's name. Stop!"

"...all fusion reactions, present and future, on Earth, Earth's moon, Mars... and everywhere inside the orbit of Mars... just in case they build any satellite bases... cease immediately and never more proceed." He raised his hands to clap.

"No!" Billton screamed, an iron hard grip of terror seizing his heart as the ultimate implication of McWhirter's wish dawned on him. "Madman."

CLAP! CLAP! CLAP! "Kaz..."

Billton's hurtling body hit hard, knocking McWhirter back against the cave wall. He jammed his right hand over McWhirter's mouth before he could complete the Word. Billton fought with all the desperation of a man battling to save his life, his world from a deadly threat. He shouted at the top of his voice, hoping to convince McWhirter by sheer force of volume where logic had failed. "Don't. For God's sake. Don't."

Their struggle took them to the feet of the genie, who sat, arms folded, unmoving, watching his two Masters fight for supremacy. Waiting for the Word.

McWhirter sank his teeth into Billton's hand, but still Billton held on. McWhirter's flaying left hand found a hard object. With the cave growing dim, his breath failing, McWhirter swung the lamp with all his flagging strength. It struck Billton behind the ear. He swung again. Billton's crazed eyes rolled upwards, and he collapsed onto McWhirter.

Desperately, McWhirter's muffled voice shouted from beneath Billton's prone body.

"Kazaam."

"Done. One wish remains, Masters."

*

Cold chablis splashed Billton's face.

"Wake up mate." McWhirter's voice rang with triumph. "We won. We did it."

Billton sat up awkwardly, feeling the back of his battered head. "What? Win?" His eyes snapped open. "How long till...?"

"Four minutes ago. The bomb went le-dud four minutes ago. And I...we did it." McWhirter gazed out towards the sunken wreck. Faye hadn't died in vain. They
~~~

found the cave. We found the lamp. The rest will be history. “The Pacific, Earth, will be safe.”

“Safe? You bloody maniac. Don’t you know what you’ve done?” Billton would have struck McWhirter, but despair robbed him of the strength. Doomed. All doomed.

“Done? I’ve saved the environment for future generations.”

“What future generations?” Billton screamed. With an effort, he focused his eyes and checked his watch. “Five minutes since your wish. I’ve got... three minutes tops. What’s that?” He turned towards the sound of voices outside the cave.

“I think we’ve been nicked. Too late for them,” McWhirter laughed.

Billton crawled to the Genie’s feet. “Genie, I wish you to reverse...”

“You cannot unwish what has already been fulfilled,” the Genie intoned. Through his drowning despair, Billton thought he detected a hint of sadness in the Genie’s rumbling bass. He studied its eyes, but saw nothing but black coals.

The voices outside were louder.

“Give it up, Billton. Leave me to...” McWhirter stared, horrified, as a stun grenade rolled through the cave entrance and stopped at Billton’s feet. Without thinking, Billton scooped it up and hurled it back through the opening. Frantic Gallic shouts were followed by a flash of light and an ear numbing concussion. A shower of coral and sand fell from the ceiling. Then silence.

Billton coughed the choking dust from his throat. He...Earth...had only one chance and less than two minutes. Did he dare? Would they understand? He squeezed his eyes shut, searching for the right words. It all seemed so unreal. He could hardly believe what he was about to say. “Genie, I wish that the planet Earth, its moon and all its artificial satellites be instantly...” think man, think... “without loss of life, relocated to a stable...” God forgive me “... unoccupied orbit of life sustaining dimensions around the next nearest... single Class G star.”

“Struth! You said I was mad. You can’t...”

“Only one minute,” Billton gasped. He raised his hands.

CLAP! CLAP!

McWhirter snatched at Billton’s hands and held them clasped, as in a vice. “Bugger you. You’re not sending my planet off to... out there.”

With a sense of deja vu the two wrestled, their hands firmly enmeshed like a mirror mime.

“Arretez!” A French legionnaire burst into the cave, his sub-machine gun held at the hip. “Mon dieu, quelle diablerie?” He stood transfixed, eye to eye with the genie.

Billton, fearing time was up, used his best schoolboy French. “Gendarme, this man is Crocodile McWhirter. He sabotaged your bomb.”

“Zut pour!” The legionnaire tore his eyes away from the genie and stared at McWhirter. “Crasseux greenie,” he spat and swung his gun butt against McWhirter’s head.

Poetic justice, Billton thought as he pulled his hands free and quickly clapped a third time. “Kazaam,” he said strongly, as in a fervent prayer, then looked up at the genie.

Incredibly, the Genie smiled.

“Done,” he boomed. “And done well.”

With the sound like a passing express train, the Genie vaporised and funnelled into the lamp. Then, in the time it took the stunned legionnaire to blink, the lamp was gone.

*

“You can hardly tell the difference,” he whispered.

“John?”

Billton turned. Joseph Masalehdani, the crew’s physician was watching him carefully.

“Doc, any news?” Billton tore his gaze from the star.

“McWhirter’s back with us. He’s eating like a...”

“Crocodile?” Billton laughed.

“It was touch and go there. I thought he was gone. He’d suffered quite a shock.”

“Well it’s not every day you realise you killed a star. Your star.”

“Where..?”

Billton pointed the Sun out to the doctor.

“A white dwarf, you say?” Masalehdani scratched his bald scalp.

“White or brown. They’re arguing about that. Collapsed by its own gravity when its nuclear furnace died. But to us it will still look like a normal G class star for the next twelve years.” He turned pained eyes on the doctor. “Then we’ll see it…go out. Like that.” The click of his fingers echoed across the deck. “Ironic, you know. It would have taken seven of Star Endeavour’s years to get here, about twenty five years of Earth’s time. Yet I’m here instantaneously by a wish. I’ve achieved my life’s dream, to travel to the stars, but not exactly the way that I planned it. Now I’ll never know if ROGR would have worked. Damn McWhirter.”

The doctor turned to go, then stopped. “Of course. There’s this. It came through from Siding Spring. All double Dutch to me. You’ll undoubtedly be interested.” He handed Billton a fax printout.

Billton scanned the data with a professional eye. “Initial identification of new sun as Tau Ceti confirmed. Single, Class G8. All closer G classes doubles with unstable planetary orbits. Genie certainly knew his astronomy. Let’s see... cooler...closer. Orbit 0.91 astronomical unit...year equals 318 days... there go some birthdays. Local system...” He frowned, then lowered the sheet. “Looks like we’ll have some adjustments to make. I’d better keep my head down when we hit port.”

“Rubbish. If it weren’t for you, we’d be back there orbiting an ice block.”

“If it weren’t for me, we would never have found the lamp.”

“If, if... Magic lamps have a way of being found. Let’s go below. I’ll mix you a nightcap your genie would be jealous of.”

“You wish.” Billton winced. “Sorry. Lead on Doc.”

They walked to the hatchway but Billton paused before descending. He looked up past the sails at the bluish-white light shining brighter than Venus once had.

He remembered the data sheet. Average orbit 1.3 astronomical units, evidence of water, continents. AM and FM radio transmissions. Artificial satellites. Damn, he thought, remembering the frantic wording of his wish. I knew I’d forgotten something. Then he recalled his debate with McWhirter about where there are Jupiters, there will be Earths. They’d overlooked the possibility that where there aren’t Jupiters, there still could be Earths. Too late now, but the SETI people really ought to double check their data on Tau Ceti.

“Come on, Doc,” Billton said. “I need that nightcap.” With one last look at the bright planet overhead, he descended the stairs, wondering if their new neighbours had nuclear fusion and what they thought ‘H’ stood for.

***

(End)

Sketching The Night Sky's Treasures At The Eyepiece

by Australian amateur Alexander Massey

All my life I've had a pencil in my hand. My parents encouraged my drawing, I think mainly because it kept me entertained and off the streets. But, without their own creative influence, I doubt my art would have found the path it has. They showed me to experiment, try new media and be willing to learn. A dear family friend spurred my interest in science.

The marriage of art and science came with Halley's Comet. Unwilling to ask my parents to kit up my 2" Tasco refractor for photography, I took up the pencil and paper. My journey with astrosketching has been ongoing ever since.

There was one major problem with my complete acceptance of astrosketching, believe it or not. The very medium I was using, paper, was my major sticking point. Its texture meant that I was a prisoner to a grainy end product. Using smooth paper was not an option – not only wasn't it available in black, but smooth paper means using a more aggressive approach to making a mark on it.

It wasn't until a chance Google search for an image of 47 Tuc, that I was to find my liberation from this textural prison. What I had thought initially to be a photo of it turned out to be a sketch! That someone actually not only had the gall to take on such a subject, but that the illustration was so true to view through the eyepiece. And then, the final surprise came that the extraordinary artist who produced this work was an Aussie!

Scott Mellish had come to be one of the most accomplished astrosketchers worldwide. What set him apart from his peers was his white on black sketches were created at the eyepiece. I had the pleasure of meeting Scott in November 2010. He most generously showed me how his technique worked, and in one hour I had the shackles of the texture of the sheet of paper fall off.

With Scott's approval and proof reading, I wrote an article on this method. I could only name this method of astrosketching "The Mellish Technique". This article is uploaded on the Australian amateur astronomy website Ice In Space, http://www.iceinspace.com.au/63-614-0-0-1-0.html .Tragically Scott passed away a short time later in April 2011.

The unique aspect of the Mellish Technique is threefold: Firstly the bulk of the sketch is done by dry painting powdered pastels; Secondly the faintest aspects of the DSO being laid down first - this being counterintuitive to more orthodox drawing methods. The third is being able to produce it quickly.

The other trait Scott and I shared was our insistence to produce our work at the eyepiece, in the dark and with only a feeble red light to see our work take shape.

Deep sky objects are not my only passion. With the Moon being a limiting factor to how many nights DSO's can be clearly observed, the Moon provides me with another source of drawing material. Sketching the Moon is probably the exact opposite to sketching DSO's – time is short as the shadows along the terminator change quickly so a rush is on; the image in the eyepiece can be painfully bright; and, these sketches are done comfortably with the lights on.

Alexander Massey.

The following deep sky object sketches were all done using my 17.5" push-pull dobsonian using a Unitron 16mm Konig eyepiece (125X). The nebulae sketches also used an OIII filter. Those of Eta Carina and Omega Centauri were done from my backyard in Sydney, M16 at Ilford, NSW. The sketch of the Moon was done with a 5" SCT from my home.


Copyright 2012, Alexander Massey


Copyright 2012, Alexander Massey

"In a Flat Spin"

Part 4

A SERIES OF ARTICLES BY MAS MEMBER **DAVY JONES**

Whilst there are still those who prey on the unwary, the falsehood of perpetual motion has to all intents and purposes been laid to rest. Having settled that question and reviewed The Laws of Thermodynamics and Kepler's Laws of Planetary Motion, it is time to consider a wider picture. In closing last month, we concluded with a few facts about our Sun and the motion of our own solar system. Before moving outward and onwards, there is still much we can learn from our own little corner of the galaxy.

The majority of the planets in our solar system rotate in a counter-clockwise direction, with two important exceptions, these being Venus and Uranus. Venus, actually rotates in a clockwise (retrograde) direction relative to the other planets - whilst Uranus, is tilted to one side, parallel to the plane of the solar system. Uranus, then, has a rather uncertain relative direction to its rotation. Uranus practically 'rolls' in orbit around the Sun; such celestial irregularities are not particularly unusual. The simple explanation for these variations in rotation can be ascribed to cosmic impacts, that took place during the solar system's formative period, permanently altering the spin of these bodies.

There are no hard and fast rules relating to the 'revolving of planets', except to say that rotation results in centrifugal acceleration that points radially from the core of the motion. The terminology used to describe a planet's continued rotation is: the conservation of angular momentum - (the physical measure of spinning). A simple example of this phenomena is that of the ice skater who, with the raising or lowering of arms, alters their speed of rotation. Taking the skater example, transfer that thought and replace the skater with a cosmic gas and dust cloud, many light years across. As the massive cloud swirls and coalesces, so its rotational speed increases dramatically over countless millennia. Conversely, a child's spinning top whilst demonstrating the conservation of angular momentum - may in slowing - provide a concrete example of - precession - which is the wobble caused by changes of axis as the speed of rotation changes. This 'wobble', as astronomers are aware, applies equally to many celestial bodies - including the Earth.

I acknowledge that many readers will by necessity have a firm grasp on the complexities of precession. Nevertheless, in the interest of understanding the concepts of various forms of motion throughout the universe, it is worthwhile summarising the basic concepts concerned here. In précis, the Earth has three main variations in its motion, these being the tilt on the Earth's rotating axis, which varies very slightly - and in modern times the tilt angle has varied between 24.5 and 22 degrees. The Earth's rotating axis swings between these two angles within a period of approximately 40,000 years. This variation is generally attributed mainly to lunar gravitational torque. Additionally, the gravitational influences of the Sun and Moon are not always the same; this results in a wobble in the motion of the Earth's axis; this wobble, called *nutation, causes the celestial poles to move, not in perfect circles, but in a sequence of S-shaped curves over periods of 18.6 years.

On top of this, the direction of the spin axis also varies with respect to distant stars over a period of some 25,800 years. This slow 'conical motion' of the Earth's axis of rotation is created by the combined gravitational actions of the Sun, the Moon, and to a lesser extent, the planets - on the equatorial bulge of our planet (see lunisolar precession). Naturally, there are other influences on the Earth's motion, not least amongst them, internal influences relating to the

Earth's core, plate tectonics, ocean currents, and global wind systems. The various 'push-me-pull-you' effects on Earth's motion being both polar and equatorial - terrestrial and cosmic - successfully create an ungainly and very wobbly old world. (*nutation = Latin - to nod)

Historically, Hipparchus (notes from circa 147BC-127BC), is credited with discovering what was known as the *precession of equinoxes. This much is confirmed from records found in Ptolemy's Almagest (see: http://farside.ph.utexas.edu/syntaxis/Almagest.pdf)

Whilst this fact might seem somewhat remarkable, it should be remembered that young Hipparchus neither fully comprehended the scientific concepts, nor the greater celestial implications of his 'discovery'. Even so, having noted his observations, future generations were then at liberty to expand on them. *(The phrase precession of equinoxes was actually coined by Copernicus).

Originally, the precession of equinoxes was so named because the equinoxes were observed to move westward along the ecliptic relative to the fixed stars. However, the 19th century brought forth improvements in scientific techniques for calculating gravitational forces between planets. It was then realised that the ecliptic itself also changed position. This resulted in a renaming of the various planetary motions into more accurate forms - the lesser being: Planetary Precession - the greater being: Lunisolar Precession - and a combination of the two, simply called, the General Precession. In 2006, the International Astronomical Union (IAU) once again recommended a name change, so that the greater precession element be called - the precession of the equator - and the lesser planetary precession be called - precession of the ecliptic. Their combination, nevertheless, remains - the general precession. For trivia buffs - the precession of equinoxes was originally explained by Sir Isaac Newton in the year 1687. (Note: ecliptic - the visible path the sun follows through the sky in a year).

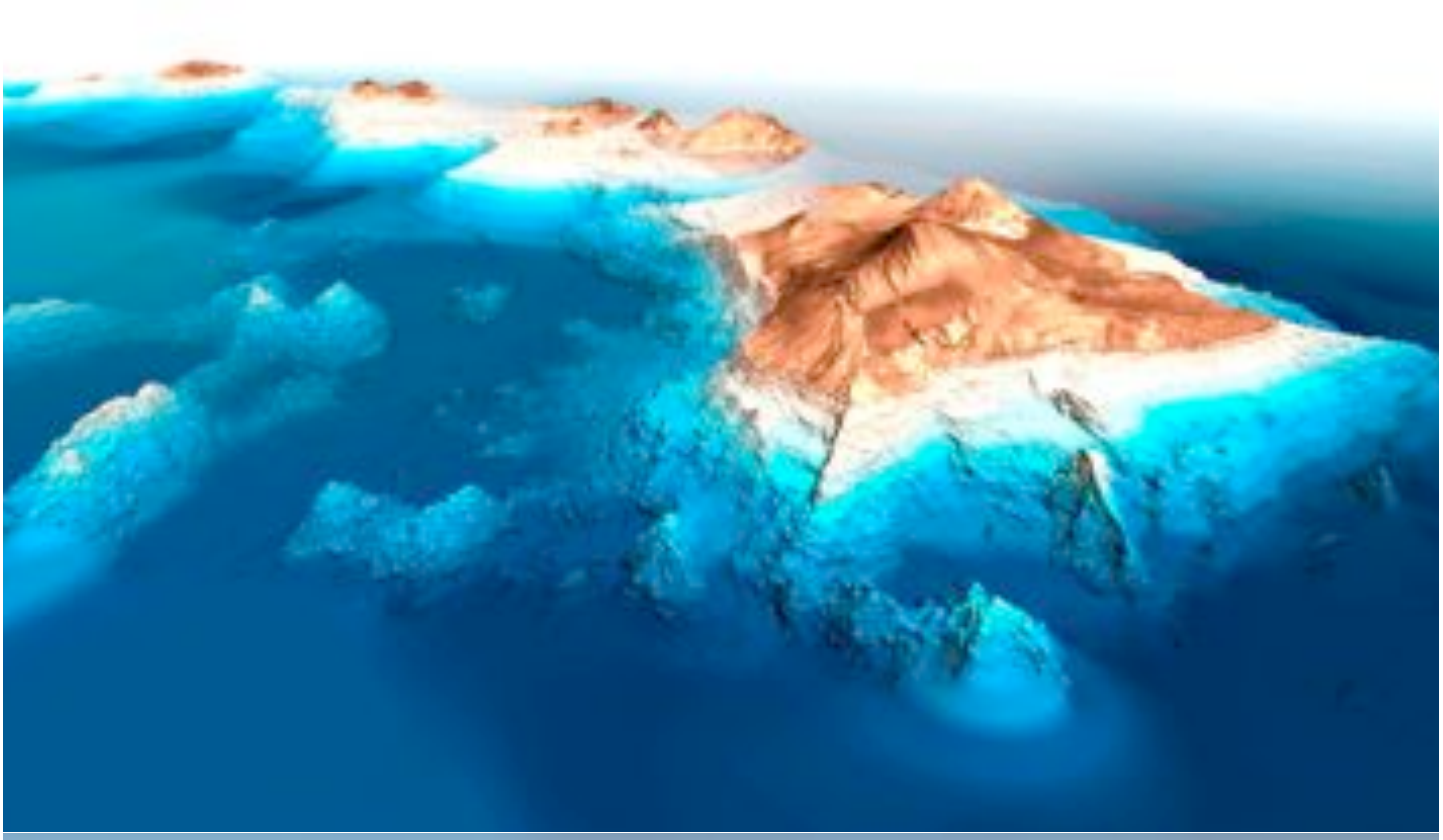
Reference material dealing with topics such as precession is liberally littered with mathematical formulae summarising the scientific conclusions. Such mathematical language leaves many of us at a distinct disadvantage, unless we are fortunate or bright enough to understand such exclusive jargon. For our purposes, suffice to say - if things don't work out mathematically - then - things just don't work! In the case of orbital motion - there must be a force to offset the orbital rotational acceleration. If there wasn't, the orbiting body would simply fly off into space. In our solar system - the Sun's gravitational pull keeps the orbiting planets and other cosmic debris in order. In the case of individual bodies, be it the Sun or any other planet, it is the self-adhesion of the body itself that keeps it together. Naturally, it follows there must be a maximum value to how fast something can rotate and still maintain its integrity within a stated environment. Gravity again plays its part in ensuring the 'body' continually falls towards the centre. If the rotation is too fast, and the outward acceleration exceeds the force bonding the object together - the object would predictably break up and fly apart.

Whilst our own solar system may not be exclusively representative of those exo-systems thus far investigated - it is reasonable to speculate that due to the centrifugal forces involved, the elements found in any solar system's planar arrangement may be, in part, predictable. Approximately 4.568 billion years ago, our solar system was born. According to the nebular hypothesis, (see E. Swedenborg) our solar system began with the gravitational collapse of a small part of a giant molecular cloud; the majority of its mass gathering at the centre, forming a core that would become our Sun. The remaining assorted debris flattened out into a proto-planetary disk. All of this material would naturally be subjected to the conservation of angular momentum, and hence, debris would be thrown out into a wide range of orbits around the central core - according to its mass and elemental make up. Naturally, much is dependent on a better understanding of the properties of the original core material.

Consider the following: The Sun contains 99.8% of the total mass of our solar system. The small inner planets, Mercury, Venus, Earth and Mars - are composed of rock and metal. The larger outer planets, Jupiter, Saturn, Uranus and Neptune are mostly made of the gases - hydrogen and helium. Little Pluto, the dwarf planet furthest from the Sun, appears to consist of ice. Incidentally, the gas giant, Jupiter is 318 times larger than the Earth, and contains the lion's share of the remaining total mass of the solar system.

The main asteroid belt lies between the orbits of Mars and Jupiter. It is estimated that 3 out of 4 asteroids consist of carbon-based rock, with the remainder being made up of iron, nickel and silica compounds. Each of the larger metal asteroids are thought to contain more iron ore than has been mined in the entire history of the human race. Whilst ever the search for exoplanets expands, so too will our understanding of the natural laws that apply to the formation and structure of solar systems, their motions and their fundamental properties.

To be continued...



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 3

AN ARTICLE BY MAS MEMBER
ROBERT BEE

100 YEARS IN COSMOLOGY

"ASTRONOMY IN WONDERLAND - CURIOUSER AND CURIOUSER" Part 3

(By Bob Bee)

Einstein's greatest mistake:

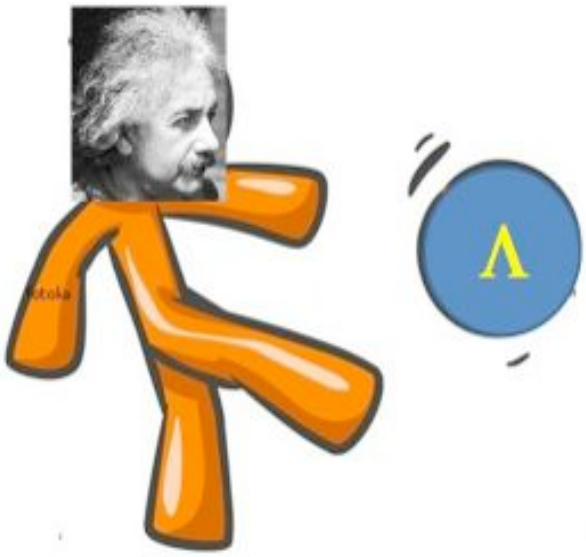
There is a well known story of Einstein, on learning of Hubble's discovery of the expanding universe, rueing his insertion of the cosmological constant Λ into his Field Equations.

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

As reported by George Gamow in his '*My World Line'* (1970): "Much later, when I was discussing cosmological problems with Einstein, he remarked that the introduction of the cosmological term was the biggest blunder of his life."

This has morphed into the folklore of modern physics. But why did he put the cosmological constant in? In simple terms, he put it into his field equations in 1917, as a last resort, to make his equations result in a static universe, which he had been led to believe was the case. Ironically, his original equations were telling him that the universe wasn't static, that is was either expanding or contracting, but his blinkered view of the universe caused him to amend the equations, resulting in him losing an opportunity to make one of the most stupendous predictions in science. And irony poured onto irony. Even when he stuck to his 'static universe' paradigm, a little further analysis on his part would have revealed the inherent instability of that state. The most infinitesimal disturbance to that state would have led to an unstoppable expansion or contraction.

So it was that when Hubble proved the universe was expanding, Einstein kicked his cosmological constant out.

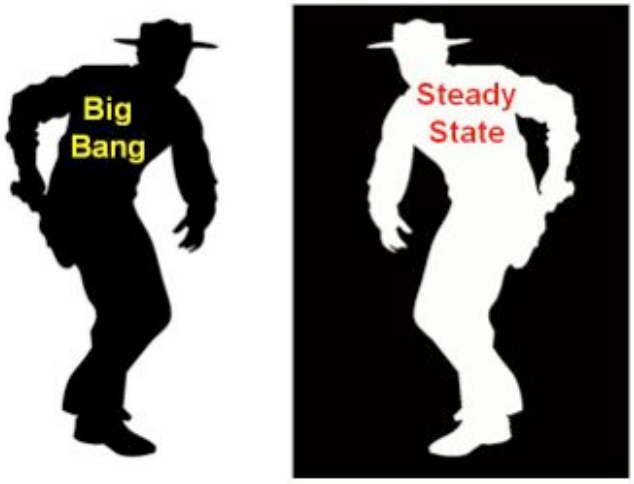


Further readings of Einstein's rationale for including the cosmological constant reveal various philosophical viewpoints and recognition of the alternative possibilities resulting from his equations. But the over-riding motivating influence was his belief, based on contemporary astronomical observations, of the effectively 'non-moving' status of the stars. Hence his aim to have his equations predict a static universe.

As we will see later, Einstein was to have the last laugh, if only posthumously. His cosmological constant was to return with a vengeance, not to cause a static universe, but a much more dramatic outcome.

So in 1929 Hubble had shown that the universe was expanding. All the galaxies were moving away from each other at a speed determined by their distance and in keeping with Hubble's Law: $\mathbf{V = H_0 \times D}$. Why was this so?

DUELLING THEORIES:



In the following two decades astronomers developed two major theories to explain the expanding universe. The theories could not have been more different in concept and description of the dynamics of the universe. There was no room for compromise. It had to be one or the other. No serious third contender arose.

THE BIG BANG THEORY.

In 1927, Abbe Georges Lemaitre, applying the Second law of Thermodynamics as a starting point, theorised that the Universe had a definite beginning in time when all matter and energy was concentrated at a small point, which exploded and everything has been expanding since, resulting in an ongoing increase in the disorder (entropy) of the system (the universe). This could explain what we see as receding galaxies, what Friedman had postulated in his expanding universe solution to Einstein's General Relativity.

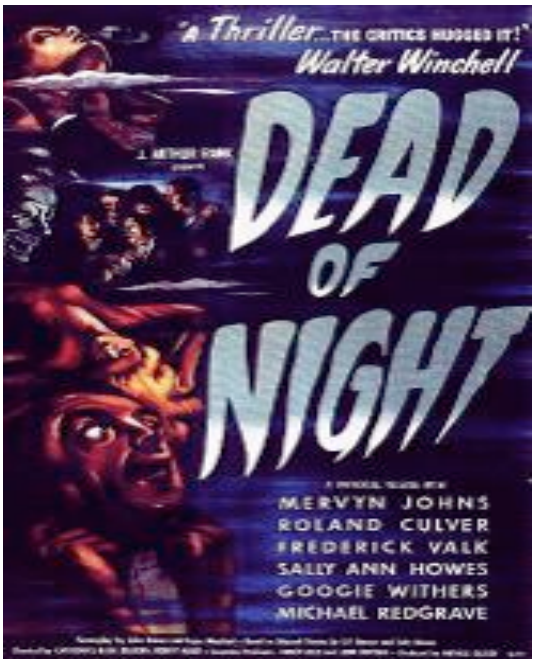
On May 9, 1931, Lemaître published his theory of the universe in the journal *Nature* and it was met with a fair degree of scepticism.

Abbe Georges Lemaitre

However, applying recent discoveries in quantum theory, George Gamow further developed Lemaitre's work, calculating the resulting energies and temperatures of the theorised universe, what temperatures the necessary fusion reactions would occur at to provide the particles and elements needed to make the observed universe. The theory was a 'work in progress', not universally accepted by any means, but worked on by more and more reputable physicists. One initial flaw in Gamow's model was his hypothesis that all the elements now seen in the universe were created in the original fireball. This was later shown to be mathematically unsupportable. However, continuing calculations on high temperature particle physics and fusion processes helped the model gain momentum until, ultimately, a credible alternative cosmological model appeared.

It is of interest that the name of Lemaitre and Gamow's theory – *The Big Bang Theory* – was not suggested by its proponents but by its opponents. Fred Hoyle, when giving a radio interview about his own theory, gently derided his competitors' theory, call it 'that big bang', and the name stuck.

THE STEADY STATE THEORY

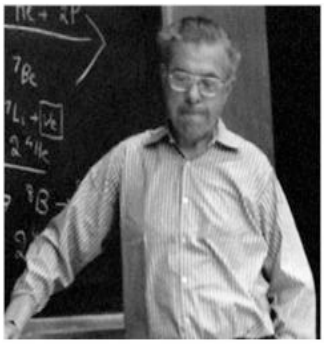


Twenty years later (around 1950), a completely alternative idea was presented by **British astronomer Fred Hoyle** and associates **Thomas Gold** and **Hermann Bondi.** Folklore has it that in 1946 these scientists watched a movie called *'Dead of Night'.*

The plot line of this movie was such that the ending returned to the beginning, in a continuous loop. This kindled the idea of a continuous universe in their heads. Gold and Bondi went on to develop the theory based on the perfect cosmological principal, with Hoyle joining the collaboration later with the mathematics to make the necessary mechanism happen.

Their theory proposed that the universe was the same in all places (homogeneous) and in all directions (isotropic) and – and this was the nub – at all times. This is consistent with the 'perfect cosmological principle'. A logical consequence of this was that it had no beginning and no end and was infinite in extent. But Hubble showed that the galaxies are all rushing away from each other. How could this be?

Thomas Gold



Fred Hoyle

This model had significant support in its day, for both scientific reasons but also philosophical and religious reasons. Hoyle, Gold and Bondi maintained that the universe was infinitely old, remained in a steady state and yet was also expanding. How did these ideas coexist?

Hermann Bondi

The 'cleverness' of the so-called *Steady State Theory* (also known as the *Infinite Universe* theory or *Continuous Creation* theory) was that the observed expansion was the result of new matter being spontaneously created, pushing the existing matter away. This was actually supportable by the theoretical quantum physics of the day. To explain this, Hoyle proposed that a field existed in space which he dubbed "the C-field", the "C" standing for creation. (This is not as strange an idea as it may seem, when you consider the current search for the Higgs boson which generates the theoretical "Higgs field" which causes all the particles to have mass.) The C-field has the

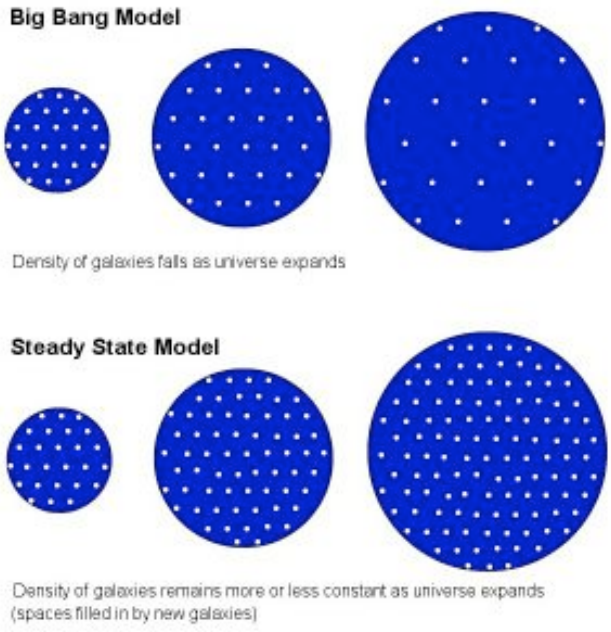
property of negative pressure, enabling it to drive the steady expansion of the cosmos, whilst also creating new matter.

The model went basically like this: The average density of the universe had to remain constant. This was achieved by new matter being created in the new areas resulting from the expansion of space. How much matter was needed to meet this requirement? Amazingly little. Every billion years, one hydrogen atom for each cubic metre of space. As insignificant as that sounds, it translates to roughly one new galaxy per year in the entire observable universe of about a hundred billion galaxies. Such a rate of introduction of new matter would be totally undetectable which is why it could not be contradicted by direct observations.

THE PROOF OF A THEORY IS IN ITS PREDICTIONS:

There was much hot debate between cosmologists at that time between these two theories. It is important to note that Friedman's work on Einstein's field equations supported both models so it was a very interesting time in the history of cosmology and cosmologists tended to fall into one camp or the other.

An idea of the difference between these two models is given by the following diagram:



Like all good theories, both the Big Bang and Steady State made predictions that should be verifiable from observations. As telescopes grew in size and radio astronomy technology improved, while the Big Bang had its setbacks, the Steady State model began to seriously wobble.

One initial setback for the Big Bang theory was that, using contemporary 'measured' values of the Hubble Constant, the approximate age of the universe was only 2 billion years. That was a problem, as the age of the Earth was confidently established at about 4.6 billion years, and there were stars whose ages had been determined to be over 10 billion years. How could the universe be younger? Obviously, this was a huge incentive to determine a more accurate value of the Hubble Constant.

The first wobble in the Steady State theory occurred in the 1950s when radio galaxies and quasars were discovered at great distances. These showed that evolving galaxies were very active billions of years ago, as predicted by the Big Bang theory. The wobble became extremely worrying when, in the 1960s, an extensive survey was done of the distribution of quasars and radio galaxies in both the near and far distant cosmos. According to the Steady State theory, there should be no difference in these distributions, whereas observations clearly showed they existed in far greater numbers in the past compared to much fewer numbers in the present epoch, as predicted by the Big Bang.

Still, the Steady State Theory held on.

WHAT SETTLED THE DISPUTE?

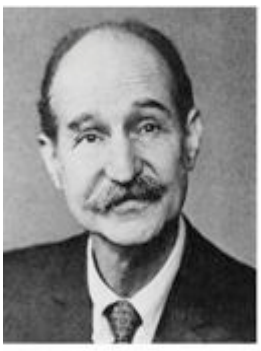
George Gamow had been a major contributor to the development of the mechanisms associated with post Big Bang eras, along with his associates Alpher and Herman.


George Gamow

They analysed what would have happened after the Big Bang and proposed that some of the chemical elements observed today were created in the first few minutes after the birth of the universe. After initial errors in suggesting all the current elements were made by the Big Bang, it was eventually realised that it did in fact create all the hydrogen and helium now seen in the universe. (We now know that all the heavier elements were 'cooked' in the nuclear furnaces of supernovae once stars were formed from the primordial hydrogen and helium.) Also it was initially hot and dense and it cooled as it expanded.


Ralph Alpha

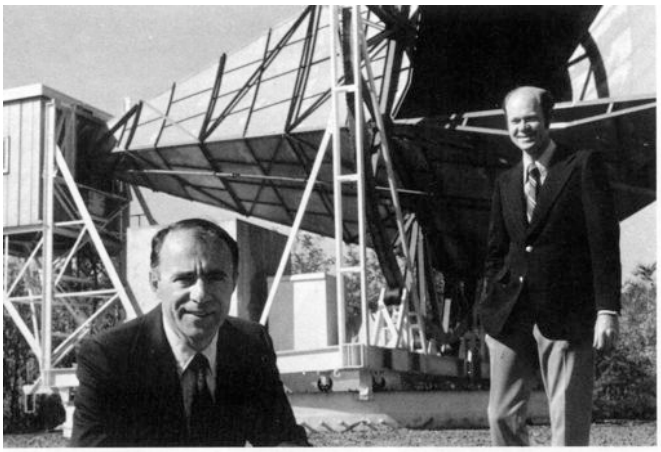
In 1948 they published a paper in which they argued that the post-Big Bang universe would go through stages of domination, first by radiation (the Radiation Era) in the form of a raging sea of energy. As this continued to expand, the energy would be largely converted to matter


Robert Herman

(the Matter Era). There would still be a remnant of energy (as radiation) which would permeate all of the universe. Alpher and Herman made a bold prediction: That this initial 4,000 degree Kelvin radiation would cool as the universe continued to expand and by this present era, would have very low energies, with a predicted temperature around 5 degrees Kelvin. The Steady State Theory made no such prediction. Obviously, the search was on to find this fossil radiation, called the Cosmic Microwave Background (CMB).

DISCOVERY OF THE COSMIC MICROWAVE BACKGROUND

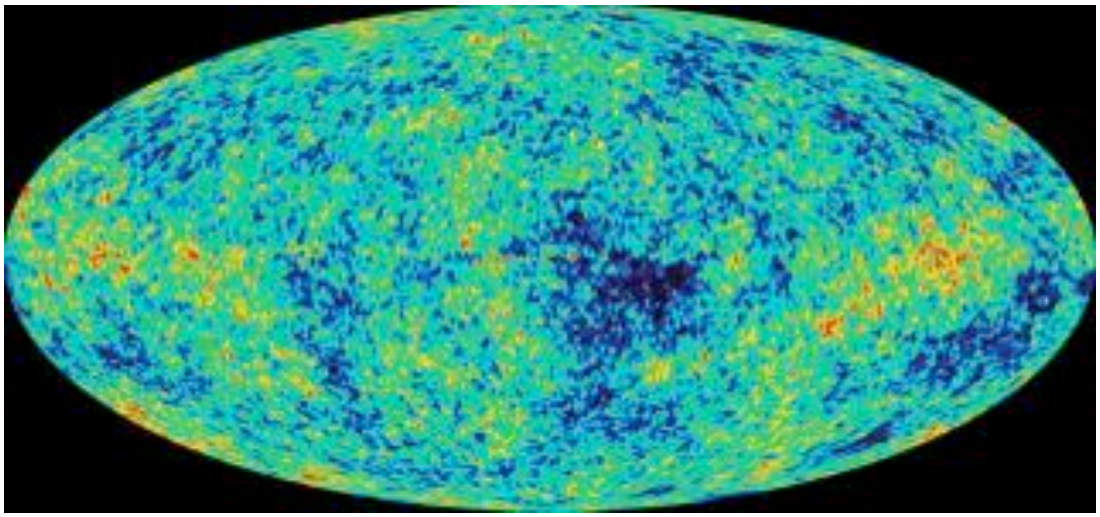
The CMB was found in 1965, by Arno Penzias and Robert Wilson**,** purely by serendipity (that is, a happy accident) while researching an unrelated radio astronomy problem. Accident or not, it won them the Nobel Prize for Physics.



Arno Penzias and Robert Wilson

Despite meticulous cleaning and checking of their horn antenna, they could not 'get rid' of this pesky and ubiquitous signal. Ubiquitous because it was detected equally from every point in the sky. It was indeed the ancient signal from the final radiation of the early universe after the Big Bang. It is seen in every direction in space and has travelled to us since 380,000 years after the Big Bang. Its measured value is now more accurately measured as 2.725°K +/- 0.001°K.

All-sky map of the Cosmic Microwave Background



This was the final nail in the coffin of the Steady State Theory as it most specifically had no room for such a radiation in its 'continuous creation' model. The Steady State Theory quietly faded into the sunset while the Big Bang Theory, with its 'smoking gun' CMB evidence became the Theory de jour. And has remained so to this day.

[As a side note, there is some irony in the fact that certain aspects of Hoyle's now defunct "C-Field" bear a striking similarity to aspects of modern cosmological models. For example, it is similar to the so-called 'inflaton field' employed in the Inflationary Theory of the Big Bang to explain a sudden exponential expansion of the early universe. More about the Inflation Theory later. It also provided a 'negative pressure' to expand the universe, which is the very similar to the effect of the resurrected cosmological constant proposed as a cause of the recently discovered acceleration of the universe's expansion. Ironic indeed.]

****

End of Part 3.

In the concluding Part 4 we will look at the Big Bang theory, the age and size of the universe and explore the mind boggling discoveries of modern cosmology including Inflation Theory, the problem of the Density Parameter, and take a trip to the Dark Side. Curiouser and curiouser.

NASA Watch: Martian Dust Devil Captured

An afternoon whirlwind on Mars lofts a twisting column of dust more than half a mile (800 meters) high in an image from the High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter.

HiRISE captured the image on Feb. 16, 2012, while the orbiter passed over the Amazonis Planitia region of northern Mars. In the area observed, paths of many previous whirlwinds, or dust devils, are visible as streaks on the dusty surface.

The active dust devil displays a delicate arc produced by a westerly breeze partway up its height. The dust plume is about 30 yards or meters in diameter.

The image was taken during the time of Martian year when that planet is farthest from the sun. Just as on Earth, winds on Mars are powered by solar heating. Exposure to the sun's rays declines during this season, yet even now, dust devils act relentlessly to clean the surface of freshly deposited dust, a little at a time.

Dust devils occur on Earth as well as on Mars. They are spinning columns of air, made visible by the dust they pull off the ground. Unlike a tornado, a dust devil typically forms on a clear day when the ground is heated by the sun, warming the air just above the ground. As heated air near the surface rises quickly through a small pocket of cooler air above it, the air may begin to rotate, if conditions are just right.

The Mars Reconnaissance Orbiter has been examining Mars with six science instruments since 2006. Now in an extended mission, the orbiter continues to provide insights into the planet's ancient environments and how processes such as wind, meteorite impacts and seasonal frosts continue to affect the Martian surface today. This mission has returned more data about Mars than all other orbital and surface missions combined.

More than 21,700 images taken by HiRISE are available for viewing on the instrument team's website: http://hirise.lpl.arizona.edu . Each observation by this telescopic camera covers several square miles, or square kilometers, and can reveal features as small as a desk.

HiRISE is operated by the University of Arizona, Tucson. The instrument was built by Ball Aerospace & Technologies Corp., Boulder, Colo. The Mars Reconnaissance Orbiter Project and the Mars Exploration Rover Project are managed by the Jet Propulsion Laboratory, Pasadena, Calif., for NASA's Science Mission Directorate, Washington. JPL is a division of the California Institute of Technology, also in Pasadena. Lockheed Martin Space Systems, Denver, built the orbiter. For more information about the Mars Reconnaissance Orbiter, see http://www.nasa.gov/mro .

Guy Webster 818-354-6278
Jet Propulsion Laboratory, Pasadena, Calif.
guy.webster@jpl.nasa.gov

ImageCredit: NASA

ESO Watch:
Many Billions of Rocky Planets in the Habitable Zones around Red Dwarfs in the Milky Way - *28th March 2012*

A new result from ESO's HARPS planet finder shows that rocky planets not much bigger than Earth are very common in the habitable zones around faint red stars. The international team estimates that there are tens of billions of such planets in the Milky Way galaxy alone, and probably about one hundred in the Sun's immediate neighbourhood. This is the first direct measurement of the frequency of super-Earths around red dwarfs, which account for 80% of the stars in the Milky Way.

This first direct estimate of the number of light planets around red dwarf stars has just been announced by an international team using observations with the HARPS spectrograph on the 3.6-metre telescope at ESO's La Silla Observatory in Chile. A recent announcement (eso1204), showing that planets are ubiquitous in our galaxy, used a different method that was not sensitive to the important class of exoplanets that lie in the habitable zones around red dwarfs.

The HARPS team has been searching for exoplanets orbiting the most common kind of star in the Milky Way — red dwarf stars (also known as M dwarfs). These stars are faint and cool compared to the Sun, but very common and long-lived, and therefore account for 80% of all the stars in the Milky Way.

"Our new observations with HARPS mean that about 40% of all red dwarf stars have a super-Earth orbiting in the habitable zone where liquid water can exist on the surface of the planet," says Xavier Bonfils (IPAG, Observatoire des Sciences de l'Univers de Grenoble, France), the leader of the team. "Because red dwarfs are so common — there are about 160 billion of them in the Milky Way — this leads us to the astonishing result that there are tens of billions of these planets in our galaxy alone."

The HARPS team surveyed a carefully chosen sample of 102 red dwarf stars in the southern skies over a six-year period. A total of nine super-Earths (planets with masses between one and ten times that of Earth) were found, including two inside the habitable zones of Gliese 581 (eso0915) and Gliese 667 C respectively. The astronomers could estimate how heavy the planets were and how far from their stars they orbited.

By combining all the data, including observations of stars that did not have planets, and looking at the fraction of existing planets that could be discovered, the team has been able to work out how common different sorts of planets are around red dwarfs. They find that the frequency of occurrence of super-Earths in the habitable zone is 41% with a range from 28% to 95%.

On the other hand, more massive planets, similar to Jupiter and Saturn in our Solar System, are found to be rare around red dwarfs. Less than 12% of red dwarfs are expected to have giant planets (with masses between 100 and 1000 times that of the Earth).

As there are many red dwarf stars close to the Sun the new estimate means that there are probably about one hundred super-Earth planets in the habitable zones around stars in the neighbourhood of the Sun at distances less than about 30 light-years.

"The habitable zone around a red dwarf, where the temperature is suitable for liquid water to exist on the surface, is much closer to the star than the Earth is to the Sun," says Stéphane Udry (Geneva Observatory and member of the team). "But red dwarfs are known to be subject to stellar eruptions or flares, which may bathe the planet in X-rays or ultraviolet radiation, and which may make life there less likely."

One of the planets discovered in the HARPS survey of red dwarfs is Gliese 667 Cc. This is the second planet in this triple star system (see eso0939 for the first) and seems to be situated close to the centre of the habitable zone. Although this planet is more than four times heavier than the Earth it is the closest twin to Earth found so far and almost certainly has the right conditions for the existence of liquid water on its surface. This is the second super-Earth planet inside the habitable zone of a red dwarf discovered during this HARPS survey, after Gliese 581d was announced in 2007 and confirmed in 2009.

"Now that we know that there are many super-Earths around nearby red dwarfs we need to identify more of them using both HARPS and future instruments. Some of these planets are expected to pass in front of their parent star as they orbit — this will open up the exciting possibility of studying the planet's atmosphere and searching for signs of life," concludes Xavier Delfosse, another member of the team (eso1210).

Notes
Correction (added 30 March 2012):

Please note that the original version of this press release incorrectly implied that the microlensing method was not sensitive to all planets around red dwarfs. This has now been corrected to say that it is not sensitive to planets in the habitable zones around red dwarfs.

ImageCredit: ESO

Bob's Knobs are the Bee's Knees!

Bob Bee

Those of you who have Schmidt- Cassegrain telescopes are probably aware of the nightmare experience of recollimating your scope when it should need it (which shouldn't be that often). Why is it such a traumatic experience? Because of those pesky screws holding the internal secondary mirror to the corrector plate at the front of the scope. These screws are supplied with either Phillips heads or Allen key heads which are impossible to adjust while simultaneously standing behind the telescope looking through the eyepiece. Believe me, I've tried. Not only is it physically difficult, it can be downright dangerous, with the ever-resent risk of the screwdriver slipping and scratching the optic's surface. At best, there s always the frustration of dropping the screwdriver (or Allen key) and having to search for it in the grass in the dark.

You usually have to recruit the help of a friend who stands at the front and makes (hopefully) minute adjustments of one screw at a time while you watch the defocussed star's diffraction circles and say 'more, more… no back a bit… stop… now try the left one… no, the other left one…": and so on. This can take for ages and is why my Celestron SCT has remained non-recollimated for at least ten years. It's just too much trouble, at least to a lazykin like me.

Then I heard about Bob's Knobs (no, not me, another Bob from the USA.) These are a set of replacement screws with knurled heads for easy gripping and turning. Theoretically, with a short SCT tube or long arms (or both), one is supposed to be able to do the collimation single handed (literally) while standing behind the scope watching the diffraction pattern while you (yes, you) make the adjustments. No communication problems. They cost around $20 to $30 a set.

I bought a set from BinTel, though I could have just as easily bought them on-line from USA. The advantage with buying them locally was that there is a range of Knobs that suit the wide variety of SCTs and if there should be a mismatch with my scope (unlikely but possible), it was a lot easier to replace them. I didn't have to.

Then I sat on these lovely knobs for about 9 months. Why? Mostly sheer laziness but partly from an irrational fear that in making the changeover I would somehow do some irreparable damage, such as not tightening them enough and letting the secondary mirror fall inwards onto the primary. Ouch! This tardiness was reinforced by the terrible weather we'd been having and the fact that my telescope was rarely bought out of its storage.

Then, with nicer weather returning after the March rains, I gave myself a good talking to and resolved to install the Bob's Knobs, if only to tick it off my 'to do' list. I read the simple instructions again with an "Oh, is it really that simple?", then checked my SCT's manual at the "How to recollimate your telescope" page, girded my loins and that afternoon took the telescope outside, laid it on the pergola table and replaced the screws with knobs, one at a time. It took me one minute. I performed a daylight 'visual' collimation looking into the front end from about 2 metres to 'align' the secondary and primary mirrors as a first approximation, then waited for night. This is how they looked mounted.

The white objects are plastic spacers provided with the knobs to give the correct internal length of the screw, plus make the knurled heads more easily accessible.

That night, I pointed the SCT at Canopus which was close to Zenith, put on high magnification (while using the diagonal) and fully defocussed it, giving a largish circular diffraction ring image. Then, I stretched my right arm around the front of the scope, located the three knobs and, while watching the image, started to adjust them minutely one by one, looking for the combination that brought the dark centre circle towards the image's centre.

I confess that this took me a while, so out of practice with recollimating was I, but I am pleased to say I achieved a very good result in about 15 minutes. I suspect that next time it would take a lot less. It has certainly given me confidence that, should recollimation ever be needed in the future, I would be able to do it lickety-spit… and by myself.

Now it needs to be recognised that if you browse through astronomy forums, every so often you will come across detractors to the worth of Bob's Knobs, and they may have personal circumstances which have given them negative views of their value. But there are many many more that sing the praises of the little gismos.

And I for one will happily say that Bob's Knobs are the Bee's Knees.

M104 - Jack Giles

Andromeda - Jack Giles

Milky Way - Roger Powell

Image Credit: Chris Malikoff

MAS **AGM** & Forum - April

Notice is given that the Annual General Meeting of Macarthur Astronomical Society will be held as follows:

Date: Monday 16th April, 2012.

Time: 7.30 pm sharp.

Venue: Lecture Room 6, Building 21
University of Western Sydney
Campbelltown Campus.

The meeting will include presentation of Annual Reports and audited accounts for 2011-12; the election of office-bearers for 2012-13; and the presentation of membership awards. The agenda will be issued to members by e-mail.

Nominations for election to the committee closed on Monday 2nd April with the Secretary.

Following the conclusion of the AGM, the meeting will continue as an Ordinary General Meeting (Macarthur Astronomy Forum).

Feature: Alexander Massey (described in article) will visit MAS to show us his astro sketching skills, and will actually demonstrate to us how to create our own on the night. Materials will be provided by MAS. This promises to be great fun! Following this will be another of "those" trivia sessions hosted by our quizmaster Trevor Rhodes. Prepare to "duck".

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.

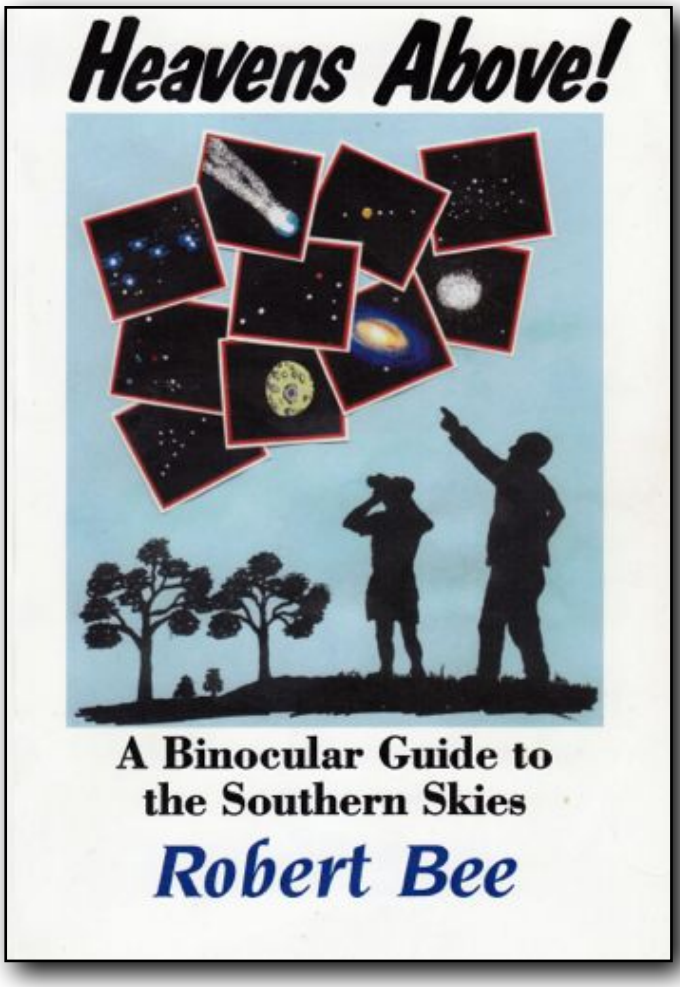
Heavens Above!

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

The Forest

This must be the most under-utilised resource that MAS provides! It amazes me that so few visit but I suspect we may have not promoted it enough.

Where is it you might ask? See the map below (it is on the website too)

It takes approximately 50 minutes to get there from Campbelltown, along the Hume Highway until you see the Belanglo State Forest sign, just past the Sutton Forest turn off. You turn right across the highway and follow the dirt road (Bunningalore Road) for approximately 4km then turn right in to Dalys Road and the cabin is the first property on the right. Keep a close watch for 'roos and wombats at all times!

The facility offers bunk beds for a maximum of 12 but you can also camp on the property as Ned and Chris do on most occasions. Bring your own pillows, bed linen or sleeping bags. There is hot and cold running water, showers and toilets. There is a complete kitchen with stove, fridge, two microwaves and sufficient crockery and cutlery. Just bring your own food and drink.

The nights are cool in summer and freezing in winter! Always ensure you have warm clothing with you and for those who intend to observe to the wee hours of the morning a freezer suit and boots is highly recommended.

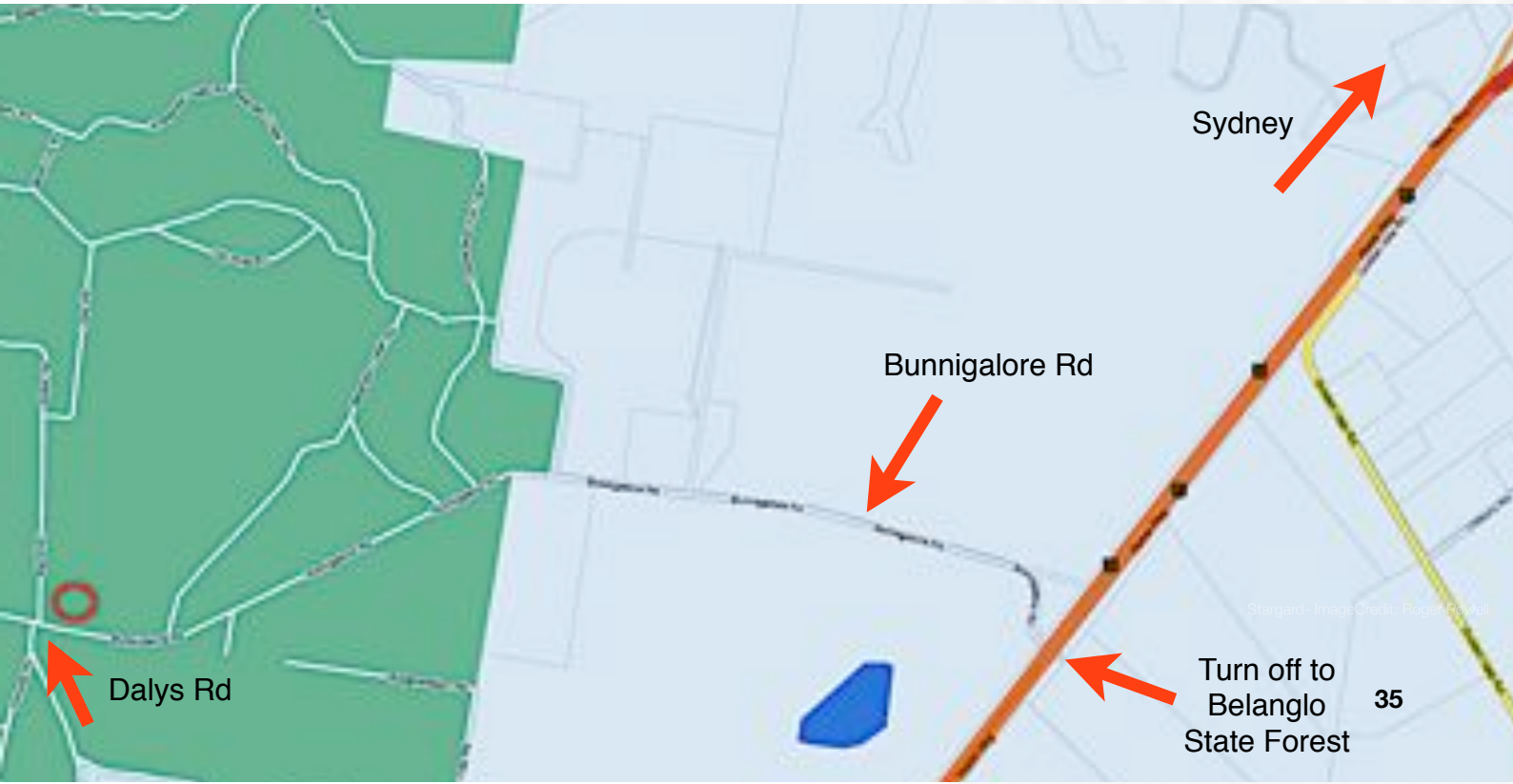
Of course you do not have to stay overnight, the Cabin is usually open from around 3pm on a Friday afternoon until Sunday morning but you can visit for a few hours or a few days. We need to know in advance if you are intending to stay on for three nights. You will be amazed at the dark skies – you can always call ahead to check on the viewing conditions.

The surrounding forest is full of wildlife, there are many walks you can do during the day, look out for our regular visitors to the cabin, 'roos, wombats, yellow tailed black cockatoos (and many other birds) and we even had an echidna visit in February! (and I swear that I saw a Sasquatch in the early morning a while back - ;) Ed)

Overall, "The Forest" is a great place to unwind, relax, meet up with friends, chat about everything, eat, drink and enjoy what nature has to offer and hopefully spot those elusive galaxies, globular clusters and other favourites of the night sky!

Hope to see you there soon!

Tony Law



M.A.S. HYSTERIA !!!