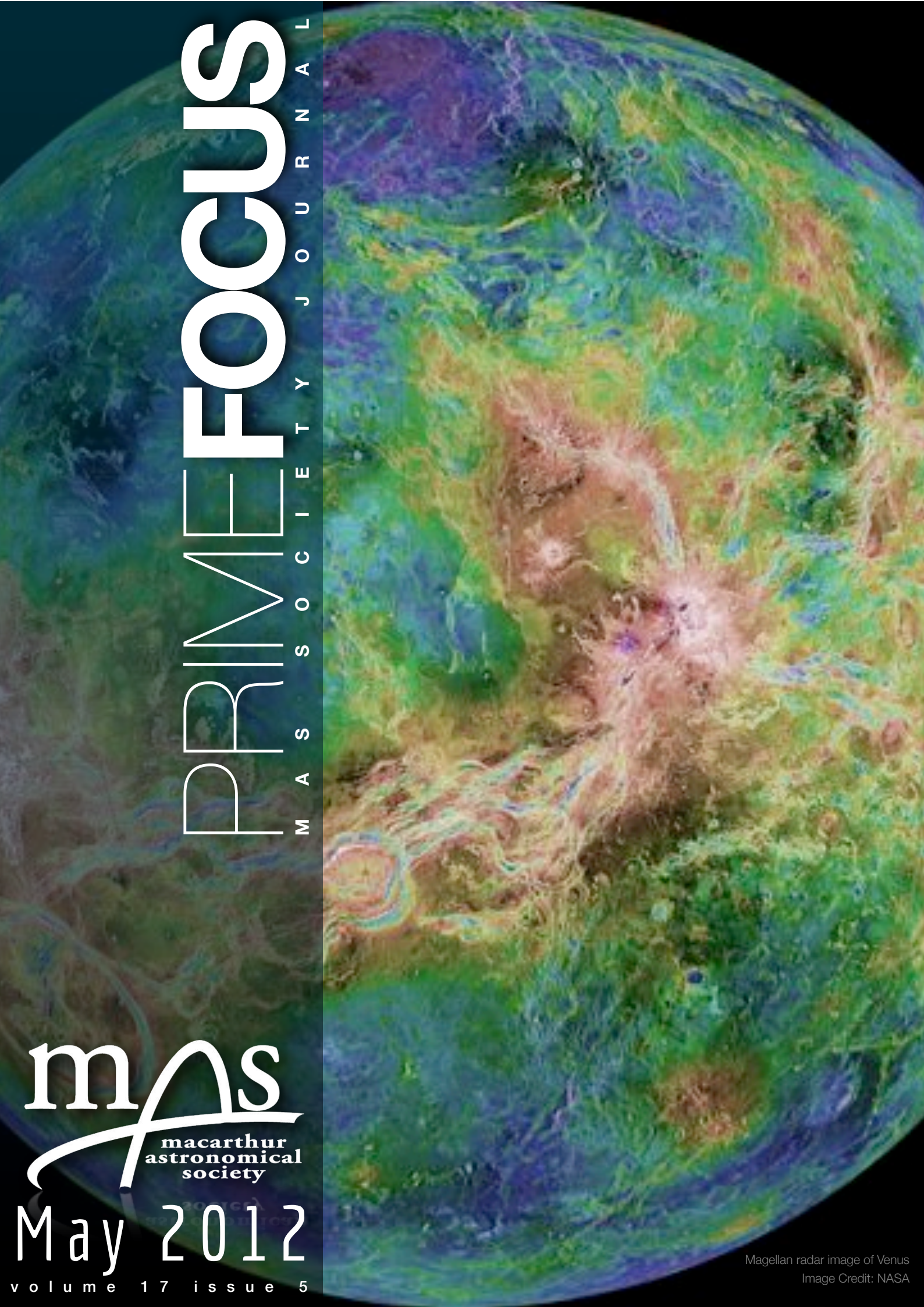
# PRIME FOCUS

MAS SOCIETY JOURNAL

macarthur astronomical society

May 2012

volume 17 issue 5

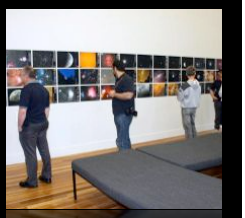


Magellan radar image of Venus
Image Credit: NASA

macarthur astronomical society

**magnitude II**
Macarthur Astronomical Society's members are proud to present a gallery of photographic images of our solar system's planets and deep space objects taken from in and around the Macarthur area.

**View our Image Gallery**
Dozens of high-quality prints will be on display in the gallery. MAS amateur astronomers will be on hand to answer your questions and delight your sense of wonder. Dusk 'till midnight, Fri, Sat & Sun: spectacular image projections onto the outside wall of the gallery.



**Equipment on Display**
Member's telescopes and astrophotographic imaging cameras will be on display to let you in on the secrets of photographing our stars. Merchandise and prints available to order.

# Sat 7th to Sun 8th July 2012

***macarthur astronomical society presents...***

# magnitude II

## skies over macarthur

### astrophotography exhibition

M42 - Humayun Qureshi

Image Credit: Humayun Qureshi

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

www.macastro.org.au

campbelltown city council

# from the editor's desk

## Welcome to the May 2012 edition of Prime Focus - "volume 17, edition 5".

***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 May 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 May edition - our fifth for the year 2012.

*Clear Skies!*
*Chris Malikoff*

## Contents





Stargard - Image Cedit: Barry Moore

# president's report

CHRIS MALIKOFF

Hello Members

I'll take this opportunity to say thanks, to everyone, for the vote of confidence in myself and in our committee that have volunteered to give up their time to make a commitment of service to you over the 2012-13 year. Everyone on the new committee is already working hard to make M.A.S. a fantastic group to be part of. To give you, the members, an active society takes a whole pile of their time, blood, sweat and ideas. I'd like to personally congratulate Tony, Nicole, Barry, Stewart, Henry and Lloyd for putting up their hands this time around.

We also have another group of dedicated members taking an active part in running our society. I'd also like to thank Roger, Trevor and Tony for forming and running our observatory funding and location-seeking sub-committee. Their contribution will further our progress over the next year, and will hopefully culminate in the building of our own facility one day. I'd like to also thank and acknowledge the following members - Noel for acting as our Stargard Liaison with Wollondilly Council, John for serving as Speaker Liaison, Carol for carting our meeting refreshments back and forth each month and Ned for making the time and effort to pick up the keys and open and close up the forest cabin each new moon. Bob, Davy, Stuart, Roger & Ursula - thanks for all your Prime Focus contributions. To all of you… a very large "*thank you*" from everyone.

There are already plenty of new things on the agenda for the coming year, so please make sure that you go to our website, log in, and look around. We also have a presence on Facebook and now Twitter (@MacAstroSoc) if you prefer to use these mediums instead. I can't guarantee the frequency in which these are updated however. When time permits we will have a completely new and even more functional website shortly. Watch this space!

To wrap up, please be part of the group. I'd like to ask that everyone become somehow involved, in whatever capacity you're able - from helping us on public nights to putting on an apron for our sausage sizzles at Bunnings. Your help is absolutely appreciated by everyone.

Clearest of skies

*Chris*


**Membership Expiry**

Membership for 2011-12 expired on 29th February. Many thanks to those members who have already paid their membership fees. Non-financial members are now advised that they had until 30th April to renew their membership, so unfortunately a nominal $10 rejoining fee will be applicable to re-enroll from this point forward.

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, M.A.S.
PO Box 17
Minto, NSW 2566

We are experiencing some difficulties with the PayPal facilities on this website, due to circumstances beyond our control. Our new website will include a complete shopping cart facility.

Not sure how much to pay? Please see the 'Join MAS' page for schedule of fees.

Not able to come to the meeting? Contact Barry or Tony for instructions on how to transfer funds on-line until we have our new site.

# speaker watch

ROGER POWELL

Guest speaker at the Macarthur Astronomy Forum in April, directly after the AGM, was Alexander Massey, an amateur astronomer from Maroubra, with a passion to sketch the objects which he observes through the eyepiece.

Astro-sketching is an art which was practised considerably more in the past when astro-imaging was a far more prohibitively expensive hobby, than it is now. I thought it had probably died out and so I was surprised to learn about Alex and his very considerable talent.

Whilst he modestly attributes his technique to the late Scott Mellish, Alex is a natural artist with great talent. How it is possible to produce such accurate renditions at the eyepiece *in darkness* (!!) is beyond me.

It's well worth revisiting the article by Alex which appeared in last month's issue (April) of Prime Focus, in which he explains his passion for sketching astronomical objects - but to truly appreciate the fine detail of his artwork, you will need to download the “print quality” version of Prime Focus from the website. Some of his sketch details are quite exquisite!

Alex showed us the basics of his technique, which is to use black and white crayons on black paper, using sandpaper and a soft paintbrush to administer dust from the crayon to capture the nebulosity. After explaining how to do it he showed us a few examples of his work, handed out the stationery and got us all sketching the Swan Nebula.

I wonder how everyone else got on with their sketching? My artistic skills can only be compared with a butcher attempting heart by-pass surgery, so my effort at sketching M17 is embarrassingly unprintable. However, after this vain attempt to sketch it from a large projected image, I think I need to revisit the Swan Nebula to see if I can pick out the same detail that Alex can through the eyepiece. It will be rising after Scorpius in the East over the next few months.

'Wikipedia' describes the Swan Nebula as follows:

The Omega Nebula, also known as the Swan Nebula, Checkmark Nebula, Lobster Nebula, and the Horseshoe Nebula (catalogued as Messier 17 or M17 and as NGC 6618) is an H II region in the constellation Sagittarius. It was discovered by Philippe Loys de Chéseaux in 1745. Charles Messier catalogued it in 1764. It is located in the rich star fields of the Sagittarius area of the Milky Way.

The Omega Nebula is between 5,000 and 6,000 light-years from Earth and it spans some 15 light-years in diameter. The cloud of interstellar matter of which this nebula is a part is roughly 40 light-years in diameter. The total mass of the Omega Nebula is an estimated 800 solar masses.

An open cluster of 35 stars lies embedded in the nebulosity and causes the gases of the nebula to shine due to radiation from these hot, young stars.

## Schedule Planner

**May-June 2012**

| DATE | EVENT | SUMMARY | TIMES |
|---|---|---|---|
| 18th May | The Forest | Members Private Observing Night. $15 per person per night. | SS 4.55 MR NM |
| 19th May | The Forest | Members Private Observing Night. $15 per person per night. | SS 4.55 MR NM |
| 20th May* | The Forest* | Members Private Observing Night. $15 per person per night. (*If held) | SS 4.54 MR NM |
| 21st May | Macarthur Astronomy Forum | Guest Speaker: Prof. Fred Watson AM (AAO). | 7.30 PM |
| 26th May | Stargard | Members Private Observing Night. | SS 4.56 MS 9.31 |
| 4th June | Astronomical event. | Partial Lunar Eclipse. | 7.59 PM - 10.07 PM |
| 6th June | Astronomical event. | Transit of Venus. | 8.16 AM - 2.44 PM |
| 9th June | Bunnings Warehouse, Narellan | MAS Sausage Sizzle - fund raising event. | tba |
| 10th June | Scout Night - Cobbitty | MAS showing Scouts the night sky for their "Astronomy" proficiency badge. Dinner provided to volunteering astronomers. Cut Hill Road Cobbitty. | 4:00 PM setup |
| 15th June | The Forest | Members Private Observing Night. $15 per person per night. | SS 4.53 MR 3.44 |
| 16th June | The Forest | Members Private Observing Night. $15 per person per night. | SS 4.53 MR 4.38 |
| 17th June* | The Forest* | Members Private Observing Night. $15 per person per night.* | SS 4.53 MR 5.31 |
| 18th June | Macarthur Astronomy Forum | Guest Speaker: Dr. Lisa Harvey-Smith. | 7.30 PM |
| 23rd June | Stargard | Members Private Observing Night. | SS 4.54 MS 8.25 |
| 7th July | Magnitude II | MAS Photographic Exhibition at Campbelltown Arts Centre - Day 1. | 10:00 AM - 4:00 PM |
| 8th July | Magnitude II | MAS Photographic Exhibition at Campbelltown Arts Centre - Day 2. | 10:00 AM - 4:00 PM |
| 14th July | Stargard | Members Private Observing Night. | SS 5.04 MR 3.24 |

Previous President Trevor Rhodes congratulates three members on their long term M.A.S. membership at the April AGM.

Geoff Young - 5 years

Ian Cook - 15 years

Dick Everett - 15 years

# “PASSWORD”

*Bob Bee*

The flat red ground was strewn with pebbles and rocks towards the horizon in all directions. The soft orange-pink sky was relentlessly uniform, offering no clouds to lend a sense of distance.

Not that Jake Perkins needed a sense of distance. He knew that it was a mere eight kilometres to the horizon, if he ever got that far, and if he did, it would be another eight kilometres of pebbles, rocks and red dust to the new horizon, and so on and so on.

Welcome to Mars, Jake thought cynically.

He turned and looked back the way he had come. Jake could see his foot prints, or more accurately boot prints, stretching back in a near perfect line towards the horizon in that direction. He knew, if he could see that far, the line wasn’t perfectly straight as he’d had to circle around a crater about five kilometres back. About two hundred metres across, it was only five metres deep at the centre, but Jake hadn’t risked the short cut across. Who could tell how deep the soft powder in the bowl was, ready to consume him like quicksand? So he’d skirted the rim, adding an extra hundred metres to his trek.

He chuckled at the thought. A hundred metres. What was that compared to the forty kilometres he’d already trudged from his crippled MEC? Martian Explorer Car? More like Monumentally Expensive Crap. Wait till he got back to Base, he’ll give the project engineering manager a royal serve, preferably a good one-third gravity boot up the bum.

Jake turned his back on his tracks. That’s if I ever get back to Base, he thought, consciously acknowledging for the first time a niggle of doubt he’d managed to keep submerged till now. For the enth time since he’d started his trek, Jake checked his suit’s chronometer. Unlike the MEC, it was still working. Like clock-work, Jake thought, suppressing a giggle, an early stage of Mars fever. Then he checked the suit’s air supply and water gauges. Nothing to giggle at there. He hit his radio’s transmit button.

“Perkins to Base… Perkins to Base, come in.”

There was a delay of seconds. Jake was about to call again when a voice spoke crisply in his ear piece. “Base to Perkins. Acknowledged.” Then the formal tone turned jovial. “It’s Bill here, Jake. How’s the hiking, old man?”

“It’s not exactly ‘valderee, valdera’ out here Bill. Thankfully it’s also not mountain tracks I’m wondering on.”

“You’ve lost me there, Jake” Bill said.

“Never mind, an old man’s joke,” Jake shook his head ruefully. How did they ever talk an old astronaut like me to take this trip with a bunch of kids? Not one of them was over twenty six. I’m getting too old for this Buck Rogers stuff. “Look Bill, can you pin-point my location? How far am I from the Saint Bernard?”

“Saint…? Oh, you mean the ERSU?”

“Yes Bill, the Emergency Re-Supply Unit. God, what did they teach you at college?”

“Mostly avionics and astro-engineering, Jake. I didn’t take the unit on religious saints. I’m an agnostic and…”

“Just tell me where the ERSU is Bill, okay?”

“Keep your helmet on, Jake, I’m checking… right, I’ve got you pegged…”

“Very funny,” Jake said.

“What?... “

“Never mind,” Jake sighed.

“Right… boy, you’re a fast walker, the distance you’ve travelled”.

“Comes from having three legs,” Jake chuckled, then cut off Bill’s puzzled reply. “And hence my need for re-supply. Bill, I’m down to only ten percent oxygen and less than that in water. This is getting serious out here, son.”

“Calm down, old feller. It’s not a matter of life or death just yet.”

“It is from where I’m standing, Bill. Let’s cut the chatter, just tell me how far to the ERSU?”

“Hold a second…” Jake could imagine Bill’s fingers flying over the computer’s keys, triangulating the ERSU’s position with his. “Um, Jake, you’d better keep walking while I work on this. You might need all the air you’ve got.” Bill’s voice had lost its jovial air.

“Oh great,” said Jake, “which direction?”

“Keep your present course, I’ll give you a correction in a minute. Base out.”

Jake resumed his steady march, made slightly easier by Mars’s one-third Earth gravity, but also frustrating as he seemed to spend as much time bouncing up and down in the thin air as he did going forward. But now the niggle of doubt had fully surfaced and transformed into a grip of cold dread. If he didn’t locate the ERSU with its store of oxygen and water he was, in simple terms, a goner. Thankfully, since they started wide ranging exploratory surface missions, they had the foresight to place fully automated re-supply units in strategic locations. Theoretically, there was always one within a suit-air-tank range of any likely exploration route.

This was the first time an ERSU had been needed in a real life… or death… situation. And I have to be the test dummy, thought Jake ruefully, just when his radio crackled again.

“Base to Perkins…”

“Perkins here.”

“Jake, the ERSU should be…”

“Should be?”

“Sorry, is… located exactly five point three kilometres from you now. Veer ten degrees left of your current course… that’s 080 magnetic… and you’ll land right on it,” Bill said.

“Thanks Bill, but it’s going to be close,” Jake said, changing course and picking up speed.

“You’ll be right. It’ll only take you one minute to hook up and replenish your supplies.” Bill paused, then added “God speed, Jake.”

“That’s comforting, coming from an agnostic,” Jake said. “But thanks anyway. Perkins out.”

The ERSU was the prettiest jumble of metal Jake had seen in many a year. Painted blue to stand out against the red landscape, Jake imagined it was also someone’s idea of an oasis, without the palm trees. He checked his air gauge. Nine minutes of supply left. Without the ERSU, that would have been a death sentence.

Jake approached the ERSU, two man-high one metre diameter tanks sitting on a squat platform with six legs. There were numerous pipes and nozzles, the most important one having a big black arrow pointing to it, with the letters $O_2$ above the arrow. “Yes, there is a god,” Jake muttered.

Carefully, Jake removed the connector tube from the rack on the $O_2$ tank’s side, connected it to the input valve of his suit, then to the tank’s nozzle. With a silent prayer, he slowly turned the nozzle anti-clockwise and watched his suit’s air gauge.

Nothing happened.

He turned the nozzle further until it came against the stop.

Still no oxygen flowed.

Fighting a rising tide of panic, Jake desperately examined the ERSU more closely. “Damn,” he said. “Read the instructions, dummy.”

Above the arrow there was a panel with the words “$O_2$ Feed Control” on it. Reading further, it said: “Open panel and initiate Feed Pump before opening supply nozzle.”

“Oh, brother.” Jake quickly closed the nozzle, then opened the panel door. There were two push buttons, one green, the other red. Above them was a small keypad with an LCD display. A large green key on the keypad said “Initiate Process”. Jake pressed it.

He looked at the LCD display and then understood the old drowning man cliché about seeing your whole life pass before you. The LCD said “Enter Password.”

After his life review brought him up to the present, he muttered “What password?” then hit his radio transmit button. “Perkins to Base… urgent… respond.”

Bill must have been sitting on his radio as the response was immediate. “Jake, how’s…”

“Cut the crap Bill, this is urgent. I’ve got eight minutes of air left and the bloody ERSU wants a password.”

“A password?”

“Yes, a password. Quick, what is it?” Jake watched his air gauge ticking down towards seven minutes.

“I’ve no idea. I’ll grab the ERSU manual.” Jake could hear the frantic flipping of pages over the radio.

“Why do they have a password, for God’s sake?” Jake asked in a rising voice.

“I think it’s to keep the Russians from using ours supplies,” Bill replied while still skimming pages.

“What Russians? We’re the only ones on Mars” Jake screamed.

“Good point… ah, here it is.” Bill read under his breath, then stopped.

“Come on,” Jake prompted. “Spill it.”

“It just says…” Bill whispered, “… enter Password. Sorry Jake, that’s it.”

“Sorries can wait. I’ve got six and a half minutes. Get onto Houston and get that password,” Jake snapped.

"But…"

"Do it…now!" Jake yelled into his helmet, almost deafening himself.

"Roger that, Jake. I'll get back. Base out."

Jake knew he was a dead man. He had six minutes of air left and the return message time from Mars to Earth was seven minutes. That was assuming Houston could answer the question immediately. Well, I'm not going to die wondering, he thought, and keyed in "ERSU" and hit 'enter'.

"*INVALID PASSWORD*" the LCD said.

Jake keyed in "OXYGEN".

"*INVALID PASSWORD*".

He keyed in "LIFE".

"*INVALID PASSWORD*".

He keyed in "GIVEMEMYBLOODYOXYGENYOUUSELESSLUMPOF SHIT".

"*INVALID PASSWORD*".

Jake checked his air gauge. Four minutes. He looked up at the orange-pink Martian sky, so beautiful. At least he had got to see that. He considered his options. Either wait till his air ran out and he slowly and painfully suffocated, or remove his helmet and breath in the poisonous sub-zero atmosphere for a quick end. He took a deep breath and checked his air gauge again. Three minutes for some last meditations.

Six minutes later, Jake's headset burst back to life. "Base to Perkins… Jake, are you there? Jake, answer…, no, no…" Bill's voiced cracked with emotion. "Oh Jake, if only you could hear me, I've got the password… too late… too late."

The funereal silence was broken by a quiet chuckle. "Late, maybe, but not dead."

"Jake? What… how..?" Bill blurted.

"You studied avionics in college. I studied English literature. While you were talking with Houston, I remembered my Lord of the Rings. The LCD didn't say 'Enter the Password', it said 'Enter…"

"…Password" they yelled together.

"And I did. The rest, as they say in the classics, was oxygen." Jake heaved a huge sigh. "I don't mind saying though, it would be good to be back at Base out of this suit. When is my pick up arriving?"

"About two hours. Does that suit?"

"Fine. I'll just wait here."

"I have to say old timer, you must have nine lives," Bill laughed.

Jack returned the laugh. "And don't forget my three legs."

*

***(End)***

# "in a flat spin"

*Part 5*

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

In recent years, the public has become desensitised to the word billion(s). As with many trite aphorisms, which roll easily off of manipulative tongues, people now just accept the mention of such large numbers in a somewhat blasé manner. However, reflect upon the following: counting at one number per second - non-stop; to simply count to a billion would take: 31 years - 251 days - 7 hours - 46 minutes and 39 seconds. When put in that context, in Australia, 1,000,000,000 - ($10^9$) - takes on a whole new meaning.

Our solar system, so often represented as a static line of coloured globes stretching out from the Sun, similarly desensitises people as to the incomprehensible nature of cosmic distances. Likewise, simple mnemonics, designed to help memorize the planets and their order, do little to impress upon anyone the incredible distances and complex movements involved in our own little corner of the galaxy: "My Very Educated Mother Just Served Us Nine Pizzas."

Pluto's orbit, our furthest dwarf planet, follows an extremely elliptical orbit around the Sun. On average, Pluto's distance from the Sun is a whooping 5.9 billion kilometres! Even at its perihelion, it still only gets within 4.44 billion km of the Sun - and at its aphelion, its most distant point, it is an incredible 7.38 billion km from the Sun.

Earth's average distance from the Sun is about 150 million km, and it is this distance, called an Astronomical Unit (AU), that astronomers use to represent our cosmic measurements. Even at this relatively short distance - 1AU - light, after leaving the Sun, still takes 8 minutes to reach the Earth. Pluto's average distance from the Sun is 39.5 AUs. Light takes a fantastic 5.5 hours travel time from the Sun to the surface of Pluto; in other words - 5.5 light hours in distance. How far away then is the nearest true planetary system to our own? The hunt, of course, is in full swing to establish just those sorts of facts - and indeed, if there are any planetary systems that might conceivably include that elusive Earth-like twin.

After our own Sun, our closest neighbouring star within the Milky Way, is Alpha Centauri, at 4.3 light years (ly) distant. That doesn't sound too far once reduced to a small digit which our 'terrestrial brains' have evolved to cope with. In fact, give or take a few kilometres, Alpha Centauri is 40,681,156,000,000 (trillion) kms. distant, and may or may not have its own planetary system. At the speed of an average commercial 747 flight - around 800km/h - were it possible - the journey from Earth to our nearest neighbouring star would take an absurd 5.8 million years - business class of course. Given that the evolutionary history of modern humans is traceable back a mere 500,000 years or so, I think it highly unlikely the human race will ever embark upon space exploration outside of our own solar system. Nevertheless, like it or not, we are but an insignificant part of a much greater celestial system, and as such, at the whims of the Milky Way's mighty forces.

In its turn, the Milky Way, an estimated 100,000 (minimal) light years across, is itself only a small part of the greater local galaxy group - the Virgo Cluster; and the Virgo Cluster in its turn, part of the yet larger - Virgo Supercluster. Now, where was I - oh yes... that's the problem with stepping out into the universe, one never knows where to stop!

The Milky Way is of course classified as a barred spiral galaxy - much like a pinwheel spinning at 970,000 k/hr (and possibly much faster). I've perhaps mentioned this before, but the fact never ceases to amaze me: given our solar system's position at approximately 30,000 ly from the Milky Way's centre - we actually complete an orbit of the galaxy roughly once every 225 million years. Effectively, the last time we were in our current

position, the age of the dinosaurs was just beginning.

For a long time, our galaxy was thought to have four distinct 'arms', whilst doubt still exists as to its actual arrangement, recent evidence suggests this might not be so.

In a 2008 article, entitled: Two of the Milky Way's Arms Go Missing - Whitney Clavin described how images from NASA's Spitzer Space Telescope are producing a clearer picture of the actual configuration of the Milky Way - revealing just two major arms of stars, as opposed to the four previously thought to exist. Likewise, National Geographic (John Roach) - June 3, 2008, carries an article outlining these same recent discoveries.

Wilkins (2011) highlights the problems that confront today's scientists when they attempt to establish facts relating to the movements and structure of the Milky Way. Living inside the formation itself is a major disadvantage; it is in fact easier to determine the organization of other galaxies than it is our own. Since 1852, when Stephen Alexander first posited our galaxy had a spiral shape, at least six arms have been identified! In the 1990s, evidence was found relating to a 'star-heavy' central bar running through the galactic plane. Clarifying this, Wilkins suggested that this central bar contains a large proportion of the Milky Way's stars - and jutting off the bar are the two main arms of the spiral. The four other arms, he suggests, are typically just gas, and therefore, he dismisses them as unimportant.

Just as one becomes settled with yet another 'valid description', of the Milky Way - even more discoveries are made. A 'new arm' - far from the galactic centre, on the other side of the galaxy - identified as an offshoot of the Scutum-Centaurus Arm - (aka the Scutum-Crux arm) - now seems to present evidence - that the Scutum-Centaurus Arm is just as large and expansive as the Perseus Arm. This discovery suggests that we live in an almost beautifully symmetrical galaxy.

Of course, it's not quite that simple! There is, it seems, a rather large anomaly to this seemingly straight-forward proposal. The reason this 'new arm' has only now been identified in such detail is because it does not lie on the galactic plane! Rather, it lies at an angle - causing it to be 'above' the rest of the Milky Way. This in turn leads to the description, that in fact, if viewed metaphorically, the Milky Way would appear much like a twisted bottle cap, after it had been removed by a bottle-opener. Not a very graceful image for the cosmic purist.

More information, this time in January 2009, from the Very Long Baseline Array (VLBA): by measuring the distances to numerous regions within a single spiral arm - determinations could be made relating to the actual angle of that particular arm. It was by this process that data was revealed suggesting the Milky Way probably has four - not two - spiral arms of dust and gas that are forming stars. The article closes with a typical scientific 'disclaimer' stating - further measurements and a deeper understanding of how our galaxy works will be required before all the answers are forthcoming.

Incidentally - the VLBA, is a system of ten radio-telescope antennas, each with a 25 metre dish, weighing 240 tons. This structure stretches from Mauna Kea, Hawaii, to St Croix in the U.S. Virgin Islands; a distance of some 8000 km.

Whatever the final conclusions relating to the basic arrangement of the Milky Way might be, I suspect, that like numerous other great mysteries, many of the answers will lie well outside of human conceptual time. All of space is extraordinarily turbulent. Space, the universe itself, and all it contains, is an incredibly dynamic environment. What exists today, may not exist tomorrow; what does not exist today, will most certainly, in some form, exist tomorrow. As fast as mere humans 'prove' one model, so unfailingly, the universe will change its configuration according to powerful forces well beyond our understanding. Obviously, the further out our investigations take us, the more prone we will be to crude assumptions or, at best, intelligent hypotheses. In the meantime, the Milky Way, as our own 'little galaxy', still holds many surprises.

And just for the curious: to count to a trillion would take approximately 32,150 years.

*To be continued…*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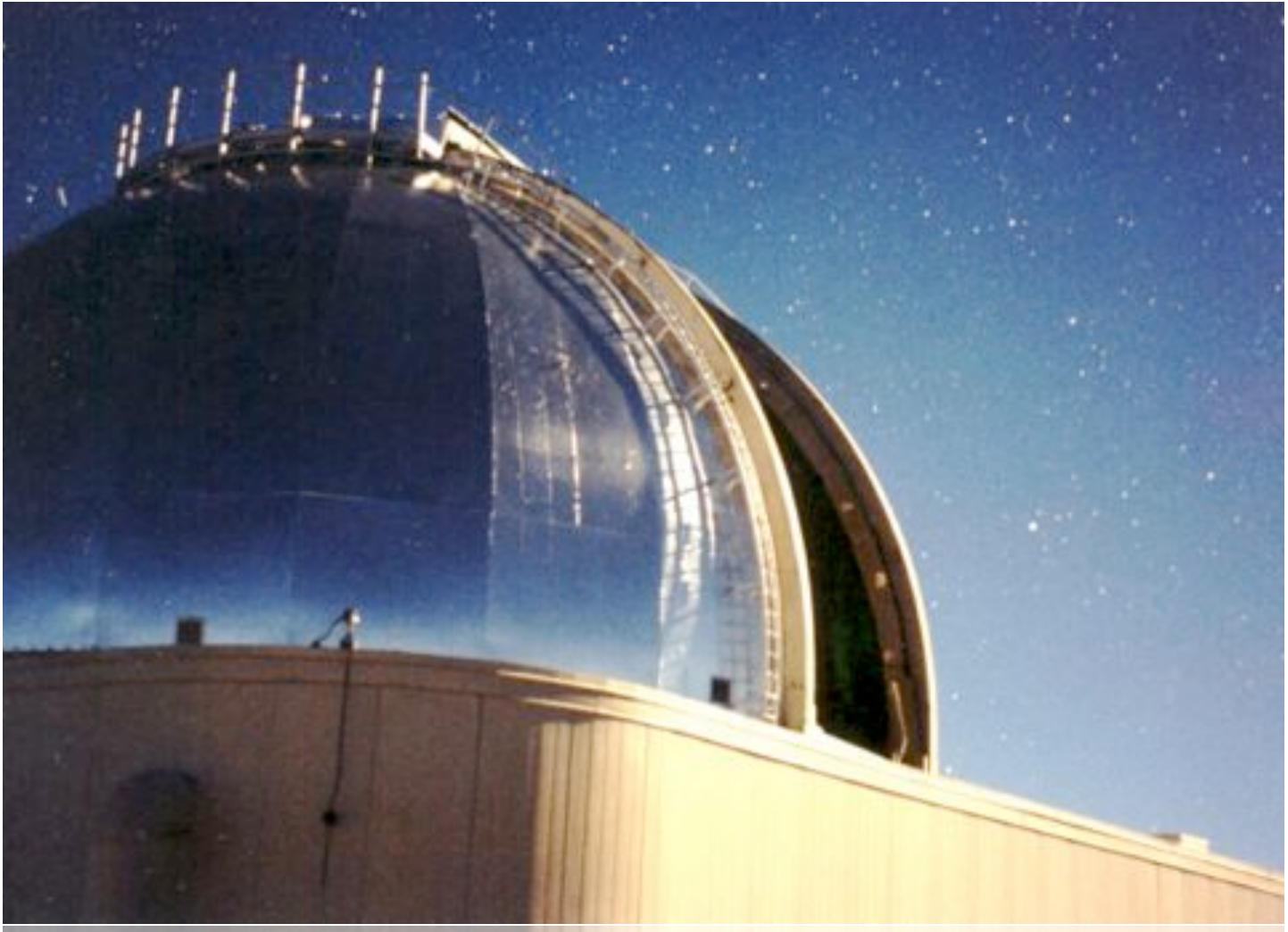


# MAS 2013: mauna kea countdown

## 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.

Contact Barry via email or 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.

# May19 Launch...
# SpaceX To Dock With ISS

Space Exploration Technologies, or SpaceX, of Hawthorne, Calif., on Friday targeted May 19 for the launch of its upcoming demonstration mission to the International Space Station.

This follows a launch dress rehearsal April 30 by the SpaceX launch team that concluded with a brief engine firing to verify the company's Falcon 9 rocket is ready to launch. The practice countdown also tested some of the systems on the Dragon spacecraft that will fly to the space station.

"Woohoo, rocket hold down firing completed and all looks good!" reported Elon Musk on his Twitter account. Musk is the owner and chief designer for SpaceX, or Space Exploration Technologies. The company's engineers are reviewing data from the test, SpaceX reported.

SpaceX is preparing for its second Commercial Orbital Transportation Services, or COTS, demonstration to show that private industry can build and launch spacecraft on regular cargo resupply missions to the station. This rocket and spacecraft will not carry people, but will have about 1,200 pounds of supplies onboard for the six astronauts and cosmonauts working on the space station.

The flight is an ambitious test for the company and the agency as they work through a new spacecraft, rocket and rework the fundamental approach to spaceflight. Even if problems develop on this particular mission, NASA officials say the agency will keep the effort going and work to resolve any issues.

Mission plans call for an extensive set of tests in space requiring the Dragon spacecraft to show that it can move precisely in orbit and approach the space station carefully. Only after these tests are successful will the spacecraft be allowed to approach the orbiting laboratory close enough to be grappled and berthed by the station's robotic arm.

Originally, this mission was to include only the launch and tests in orbit rather than physically connecting to the station. If the Dragon is unable to complete its tests successfully, NASA expects to work with SpaceX to resolve whatever issues develop and accomplish a rendezvous and docking on the third demonstration mission. That would not set back any of NASA's plans for future cargo missions to the station because it would be following the parameters the agency originally established for the COTS contract with SpaceX.

As SpaceX continued its launch preparations at Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida, the static test firing gave the launch team a good indication of its readiness. The ignition for the static fire test took place at 4:15 p.m., about 45 minutes after a last-minute technical issue scrubbed the first attempt. After troubleshooting, the launch team recycled the countdown. While good practice for a launch scenario, the issue would have scrubbed the day's opportunity on a real launch day because the rocket has an instantaneous window in order to catch the space station.

The Falcon 9 is powered by nine Merlin engines, and SpaceX reports that all nine were lit and run at full power for two seconds during the test The rocket's second stage is powered by a Merlin vacuum engine, which runs on refined kerosene and liquid oxygen, the same fuel and oxygen combination that was used on NASA's Saturn V moon rocket first stage.

The SpaceX mission will be a landmark for the privately run company that used the same rocket/spacecraft combination in December 2010, to become the first private organization to launch and recover a spacecraft from Earth orbit.

This time, SpaceX's Dragon capsule is scheduled to operate in space for about three weeks, including an unprecedented rendezvous and berthing to the space station. If successful, the mission will give the company another place in the record books.

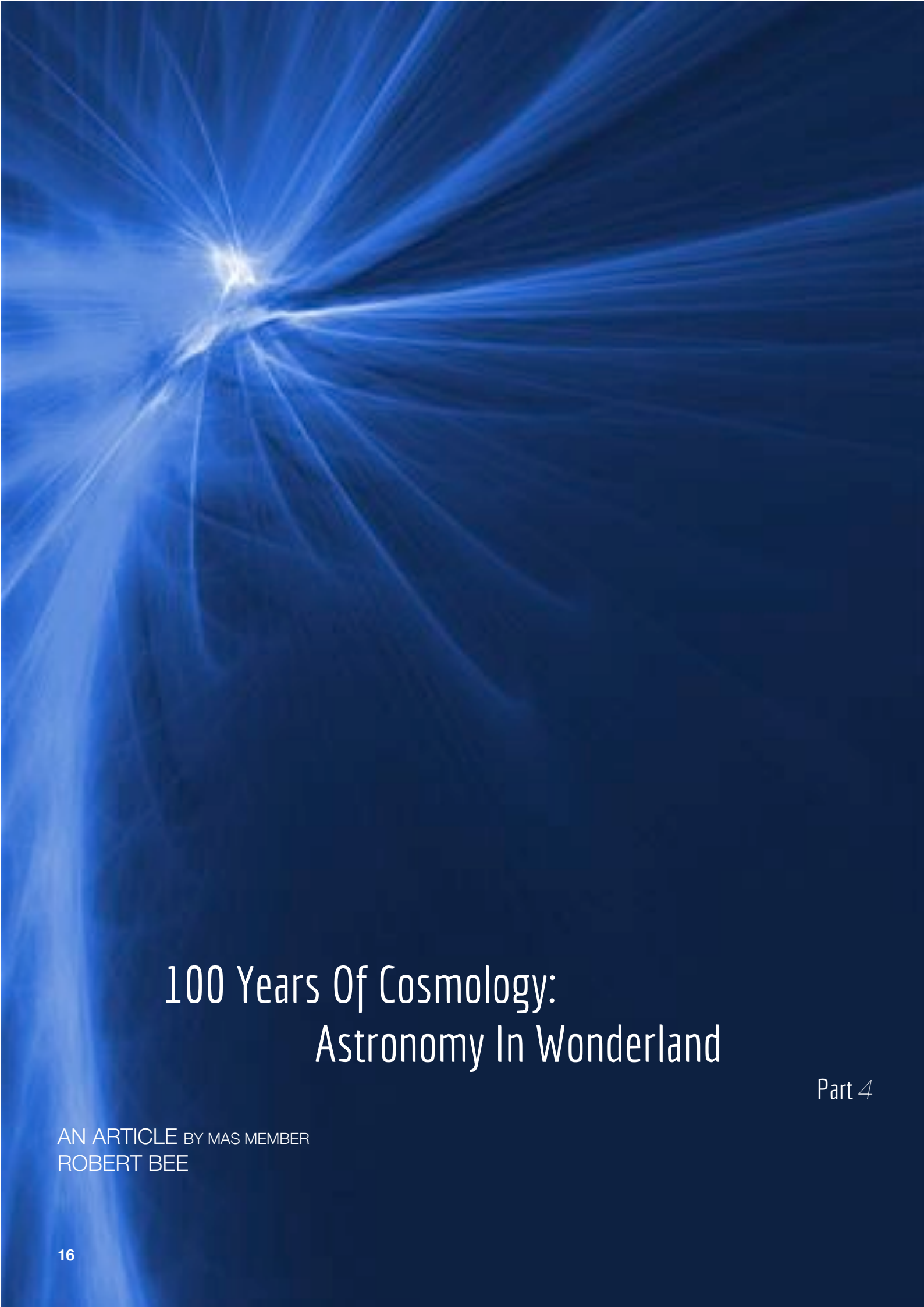
NASA wants private industry to deliver cargo to the orbiting laboratory on a regular basis. NASA awarded COTS space act agreements to SpaceX and Orbital Sciences Corp. of Dulles, Va., to help them develop their rockets and spacecraft.

NASA engineers and flight controllers are closely working with SpaceX ahead of this flight to coordinate the intricate approach, rendezvous and birthing plans needed for this historic demonstration mission to the International Space Station.

**Steven Siceloff**
**NASA's John F. Kennedy Space Center**



ImageCredit: NASA



# 100 Years Of Cosmology: Astronomy In Wonderland

Part 4

AN ARTICLE BY MAS MEMBER
ROBERT BEE

## 100 YEARS IN COSMOLOGY

### *"ASTRONOMY IN WONDERLAND - CURIOUSER AND CURIOUSER" Part 4*

**(By Bob Bee)**

In Part 3 we looked at the history of the Big Bang Theory and how it saw off the discredited Steady State (or Continuous Creation) Theory. The Big Bang is currently the generally accepted model of how the universe developed from the initial highly dense super-hot 'singularity'. It should be noted that physicists and cosmologists do not claim to know what happened before that sudden expansion nor what the trigger for it was. But they are confident in their explanation of what followed after the first $10^{-43}$ seconds.

### WHAT IS THE BIG BANG THEORY?

The details are very complex and an article of this length cannot hope to give a comprehensive description. After all, this is a history of cosmology, not a text book on the subject. However, here is a simplified explanation of the theory that cosmologists developed.

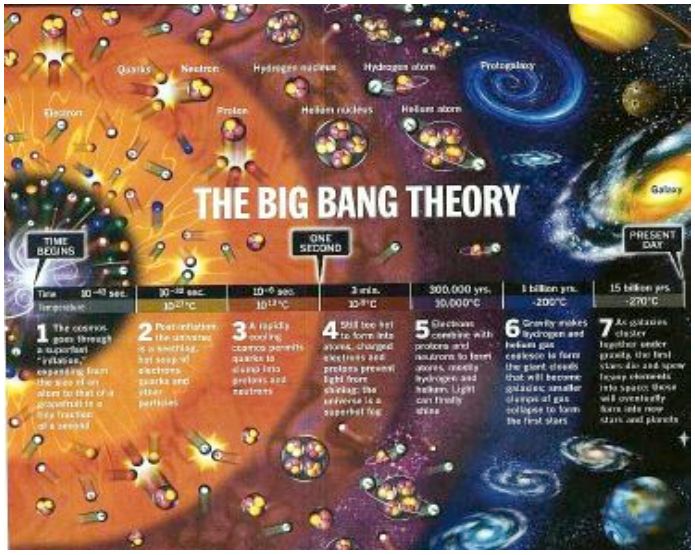
The Universe started as an extremely small speck of matter (smaller than a grain of salt). But it was unimaginably dense and hot at it had to contain all the matter and energy of the universe as we know it now.

Then, for reasons no one knows (and cosmologists don't pretend to know), it suddenly 'exploded' (or more precisely, unfolded time and matter) and the Universe started expanding at a furious rate while extremely hot but cooling as it expanded. In a trillionth of a trillionth of a trillionth of a second, it doubled in size at least 100 times (a size increase factor of $10^{43}$). This aspect of the theory is called The Inflation Model which was developed at a later stage – more of that in a moment. This resulted in a super-hot super dense mixture of matter and energy.

After Inflation, it continued to expand but at a much slower rate, the universe cooled and became less dense. A very brief timeline of that expansion and cooling is:

- 1 second after 'Big Bang' (t = 1 second), the cosmic temperature was approximately 10 billion degrees Kelvin.
- At t = 3 seconds, the Universe was a scorching plasma of photons (radiation) and quarks (subatomic particles) smashing together to form protons and neutrons. They call this the Quark-Gluon Plasma.
- There was a furious process of creation, then collision and annihilation of matter and anti-matter, causing huge amounts of radiation and heat.
- After t = 3 minutes, all the hydrogen and helium nuclei of the universe had been created, but ionised as it was too hot to retain electrons. Apart from a negligible trace of Lithium, there were no other chemical elements existing.
- This went on for about 380,000 years, the Radiation Era. At the end of this time, the Universe had cooled to 4,000 degrees Kelvin and the hydrogen and helium nuclei were able to capture and hold free electrons, forming electrically neutral atoms of hydrogen and helium. The cosmos became transparent and astronomers can 'see' what was happening. This was the 'Matter Era'.
- It was this final 4,000 degrees that, red shifted over the distance and time since then was observed as the cold 2.725°K CMB. That is the hiss of static on your radio or TV between stations.

Since then, the universe continued to expand and went through the long process of gravitationally collecting the hydrogen and helium gas to form galaxy clusters, then galaxies and stars, leading ultimately to the universe we see today in our telescopes.




### WHAT IS THE INFLATION THEORY?

The original Big Bang theory was plagued by some difficult conundrums which the then 'Hot Big Bang Theory' could not explain. These were:

**The Horizon problem:** Why is the universe, in all directions, the same temperature, homogenous and isotropic when in the time of the age of the universe the opposite extremes could not possibly have 'communicated' with each other at the speed of light to reach an equilibrium state?

**The Flatness/Fine Tuning problem:** Why is the Universe 'Flat' (as they believed) with such small

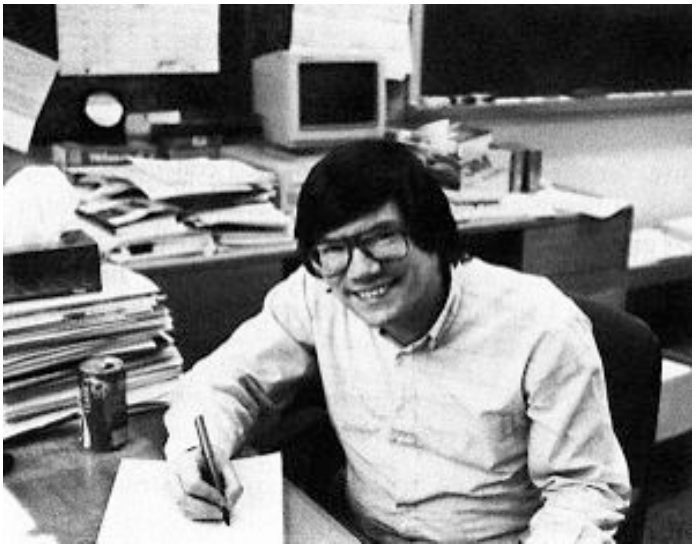
curvature? It hadn't had time to reach that state of low curvature, or flatness.

**The magnetic monopole (or lack of them) problem:** A complex issue I won't go into here. However, the Hot Big Bang Theory predicted if the early universe was very hot, a large number of very heavy, stable magnetic monopoles would be produced. These simply have not been found. Why?

**The origin of density fluctuations** (that led to clumping for galaxies). From the CMB it was seen that density fluctuations across the entire 380,000 year old universe are incredibly small (in the order of 1 in 100,000). How could they have been smoothed out so effectively?

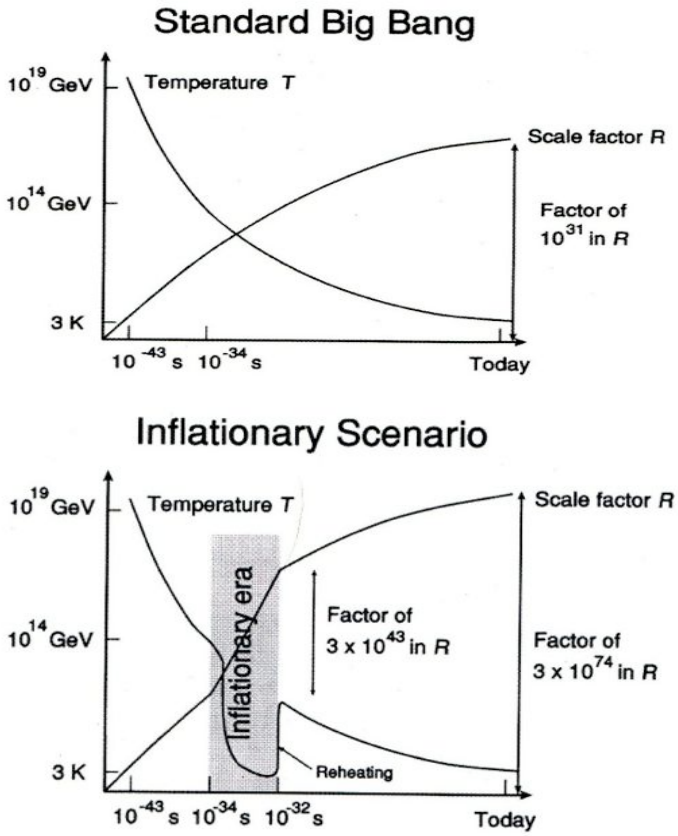
These problems weighed heavily on the Big Bang Theory, undermining some confidence in it. This was soon to change.

In 1979, 32 year old Alan Guth, an American theoretical physicist and cosmologist was researching particle physics on the particular issue of magnetic dipoles.



**Alan Guth**

On the night of December 6th, he had a sudden inspiration that was to change the theory of cosmology. What if, he thought, after the very beginning of the Big Bang, starting at t = $10^{-34}$ seconds and through to $10^{-32}$ seconds, all the dimensions in the universe increased exponentially by a factor of $e^{100}$, or about $10^{43}$? Thus was born the concept of cosmic inflation, leading finally to the 'Hot Inflationary Big Bang Theory', now the Standard Model. A comparison of the rate of cosmic expansion and Scale factor for the original and Inflationary Big Bang models is shown below:




Where did the impetus for this inflation come from? Supposedly from some unknown (as then) repulsive force which, incredibly (and thankfully for us), switched itself off after t = $10^{-32}$ seconds. This idea may have been laughed out of town if it didn't overnight solve all of those conundrums listed before. The unbelievably fast and huge expansion of the minuscule and irregular pre $10^{-34}$ seconds old universe provided answers to all those questions. The explanations are again too long to include here.

So that was the state of understanding of the Universe around the 1970s. Then things took another interesting turn. The universe has a way of continually teaching cosmologists a lesson in humility.

**AT THIS STAGE THERE WAS A MAJOR COSMOLOGICAL PROBLEM:**

I have already mentioned the Density Parameter Ω which is the ratio of the observed average density of the Universe to the 'critical density'. The critical density is that value which divides 'expansion forever' from 'ultimate contraction'.

Now the Critical Density has a real value. It is $10^{-26}$ kg/m$^3$ – extremely small. That is equivalent to 5.9 hydrogen atoms per cubic meter. Compare this to the air we breathe which has $10^{25}$ particles/m$^3$. The best vacuum on Earth, inside the beam tube at the Large Hadron Collider, has $10^{15}$ atoms/m$^3$.

Now from calculations of all the matter in all the galaxies in the observable universe, the total Density Parameter only came to 0.04. That's a lot less than 1.0. This suggests that the Universe has an open

(hyperbolic) geometry, not flat (Euclidean) and will expand without limit.

Cosmologists were extremely uncomfortable with that. They were convinced that the universe was flat, for reasons that are too lengthy to cover here.

But where was the extra necessary matter to bring Ω up to 1?

**THEN SOME MAJOR AND AMAZING DISCOVERIES WERE MADE.**


**DARK MATTER**

In 1933, a very cantankerous astronomer, Fritz Zwicky, pointed out unusual results with his measurements of the mass of the Coma Cluster of galaxies (in the Coma Berenices constellation), using the motion of galaxies at the fringe of the cluster.

**Fritz Zwicky**

He calculated that it contained 400 more times the mass than expected from what telescopes could see. He concluded that there must be a huge amount of 'invisible' matter with enough mass (and ergo gravity) to prevent the cluster from flying apart.

He was generally ignored by his peers, whom he famously described as 'spherical bastards'. That is, "they were bastards from whatever direction you looked at them." History would show that Zwicky was a genuine astronomy genius, but he clearly lacked people skills.

Then in 1975, astronomer Vera Rubin did similar calculations and observations for stars on the outskirts of spiral galaxies.

**Vera Rubin**

They were moving at the speeds that the visible matter could not account for. She suggested that up to 50% of the mass of the galaxy must be contained in a dark halo enveloping the galaxy. The justified ghost of Zwicky returned.

In fact, now astronomers believe that 85% of all the matter that makes up the Universe consists of this invisible Dark Matter. The remaining 15% is the visible stuff, made of protons, neutrons and electrons that we see in galaxies, stars, planets, gas etc.

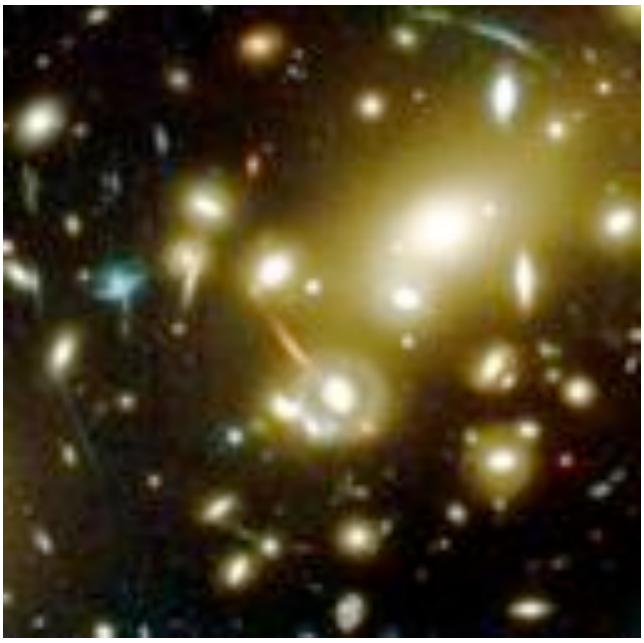
**WHAT IS DARK MATTER?**

No-one knows yet, but there's a Nobel Prize waiting for the discoverer. There are currently two main streams of thought. One is that it is comprised of ordinary matter (but not stars or dust), dubbed MACHOS for Massive Compact Halo Objects, such as Jupiter sized planets, black holes, brown dwarfs. The other stream is it is some exotic particle from new physics, weakly interacting massive particles, or WIMPS. The jury is very much out on this. There is hope that experiments at the newly commissioned Large Hadron Collider may shed light on Dark Matter.

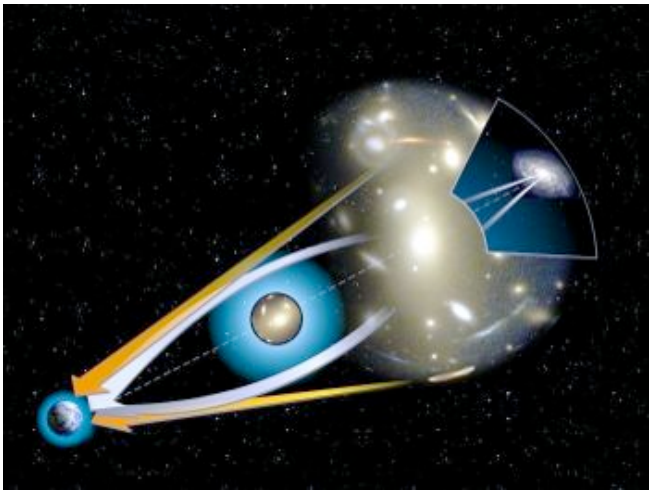
Dark matter, or at least its effects, can be seen directly by what is called Gravitational Lensing. Just like the lenses in our glasses bend the light to help us see

better, huge concentrations of Dark Matter can bend the light from objects far behind them to bring them into our view.

Here is an example of Gravitational Lensing.



Galaxies beyond an intermediate star cluster, its mass greatly increased by its dark matter, have their images distorted by the cluster's gravity, appearing as arcs rather than their true galactic shape. This effect is demonstrated by the following diagram.

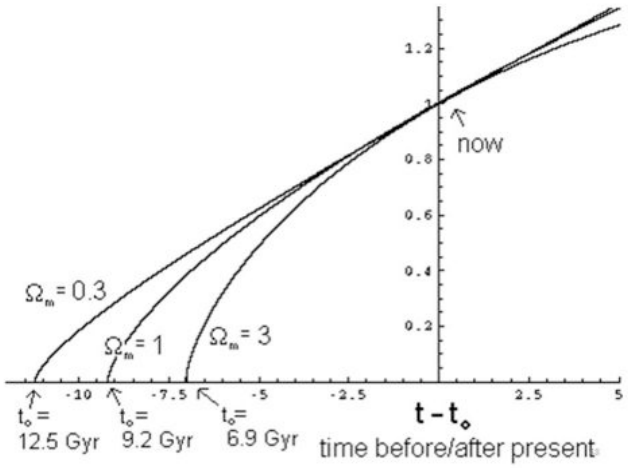


So Dark Matter, whatever it is, is real and huge amounts of it surround all the galaxies, including ours.

A major benefit of Dark Matter for the cosmology theorists was that it helped with the Flat Universe problem. When the amount of Dark Matter was allowed for in the Matter Density Parameter $\Omega_M$, it came to about $\Omega_M = 0.3$. This is much closer to 1 than the 0.04 for visible matter alone. But not close enough. It would still suggest that the universe is NOT FLAT.

Cosmologists were still convinced $\Omega$ should = 1. They had a conundrum.

Another conundrum: If the Universe was only made of 100% matter (normal and dark), then the universe has been decelerating while expanding. Theory tells astronomers that for a value of $\Omega_M = 1$, computing the age of the universe is given simply by 2/3 x $1/H_o$.




But for a value of $H_o = 72$, this gives an age of the universe of 9 billion years. This is much less than the 12 billion years age of the oldest stars in globular clusters.

That's not good. The baby is older than the mother!

That is a good argument for $\Omega_M < 1$, say 0.3, which as the above chart shows, gives and age of 12.5 billion years, very close to what was expected.

But they still need the $\Omega = 1$ for a Flat universe. An extra 0.7 for $\Omega$ would be nice. Yes, cosmologists wanted the best of both worlds. What to do to solve this conundrum?

**DARK ENERGY**

Up until 1998, cosmologists were debating what the ultimate fate of the universe was. Would it:

a) Slow its expansion, stop, then contract to a Big Crunch?

b) Slow its expansion to a halt and stay there?

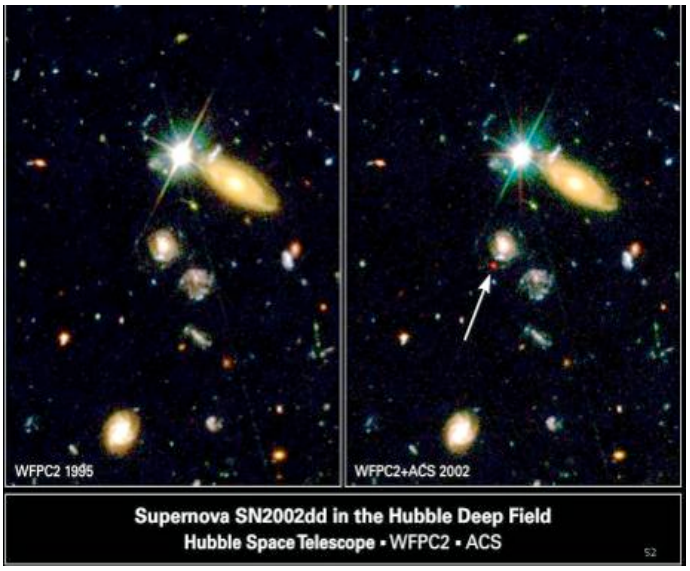
c) Slow its rapid expansion but never quite halt, continuing a slow expansion to a Big Cool?

It all depended on the total mass of the Universe. The 'smart money' was on b) or c).

This was completely turned on its head in 1998 when a fourth alternative was discovered.

Two independent teams of astronomers published their results of extensive studies of distances to extremely remote Type 1a supernovae. (These supernovae were excellent standard candles of known luminosity. They result from the total annihilation of a

white dwarf star when is accumulates enough matter from a binary partner red giant to reach a critical mass of 1.44 solar masses.)




Looking back into the earlier life of the Universe (about 5 billion light years away, or z = 0.7), they were shocked to find that these supernovae were further away than expected. There was only one possible conclusion:

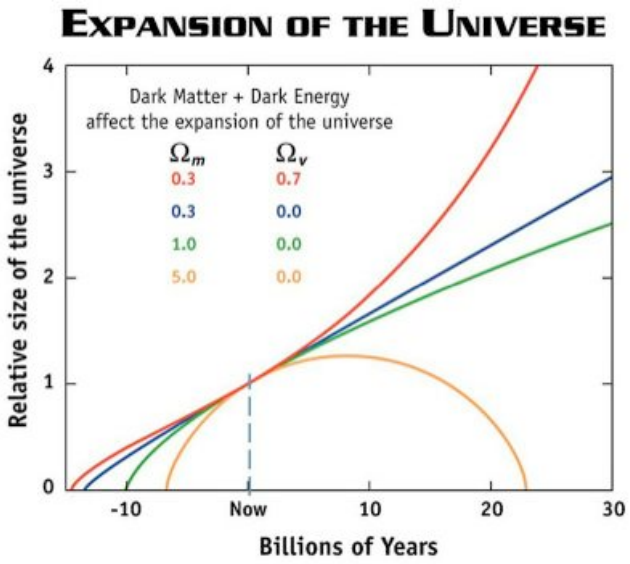
**The universe now is expanding at a faster speed than it was then. The Hubble Constant now is higher than it was back then. The universe's expansion is accelerating!**

There are many proposals as to why this is so. But they generally come under one title: **Dark Energy**. Some strange energy in the vacuum of space itself, is causing space to expand faster, carrying the galaxies along with it.

It's a very complex question, with varying theories to explain it. But no-one is seriously arguing against the accelerating universe theory.

Ironically, it is behaving exactly as Einstein's Cosmological Constant said it would, and now it is agreed Einstein should have left that term in his field equations. This Dark Energy now has the symbol Λ (Lambda) for that reason.

The amazing thing is that the supernova study teams were able to find Type 1a supernovae even further back in time, as far as 8 billion years (or z = 1.2). To their relief, they found that these were closer than they would have been if the universe was accelerating at that era. It meant that the initial expansion of the universe was decelerating (as always originally thought), then Dark Energy started to battle gravity and the universe expansion coasted, then after about 8 billion years after the Big Bang, the Dark Energy dominated gravity and the universe's expansion started to accelerate. This is shown by the red 'S' curve in the following diagram. It shows that at the present era, the coasting has stopped and acceleration is underway. The other curves (with their colour keys) show the expansion rates for the other possible values of $\Omega_M$ and $\Omega_\Lambda$.

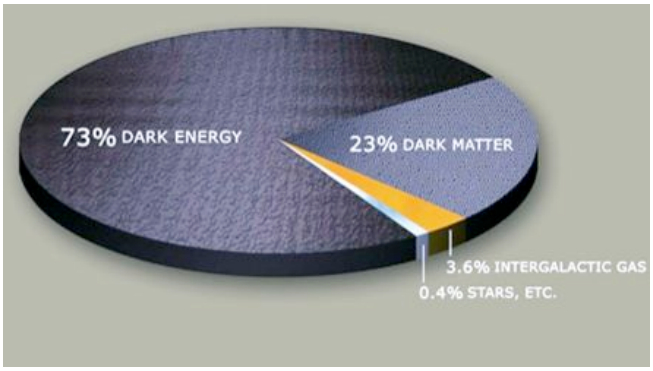



The shape of the Scale Curve allows cosmologists to measure the amount of Dark Energy and its mass equivalence in the Density Parameter equation. Remember that, with $E = Mc^2$, the Dark Energy can be counted in the mass-energy Density Parameter. And the $\Omega_\Lambda$ works out to be ~ 0.7. That is, $\Omega_{Tot} = \Omega_M (0.3) + \Omega_\Lambda(0.7) = 1$. This, happily, solves the cosmologists' conundrum.

This keeps the universe FLAT. Also, applying the shape of the S curve and the measured values of the Hubble constant along it, gives a very confident age of the Universe of 13.7 +/- 0.1 billion years. The 'coasting' and acceleration has moved the age up from the previous 9.2 billion years for deceleration only.

By pure coincidence, for $\Omega_M = 0.3$ and $\Omega_\Lambda = 0.7$, the slowing down and then speeding up about balance out and the time elapsed from the Big Bang to now works out the same as simply taking $1/H_o$ for $H_o = 72$ km/s/mpc. 13.7 billion years. Fluke?

More accurate measurements have since been done, giving the whole universe's matter/energy budget to be made up of:



**73% Dark Energy, 23% Dark matter and a mere 4% of 'normal' matter.**

That is all the bits of the Universe that we can actually see makes up only 4% of the whole Universe. The rest is DARK. That is very humbling.

Since then, independent measurements based on the CMB were able to measure the geometry of larger scale universe and arrived at $\Omega_{total}$ = 1.0 +/- 0.04. i.e $\Omega$ = 1.

This independently validated the existence of Dark Energy, Flatness of the Universe, and Inflation after Big Bang.

The cosmological pieces were falling into place like the final pieces of a jig-saw.

**SO, WHAT DOES THAT MEAN IN TERMS OF THE FATE OF THE UNIVERSE?**

A new scenario d) is: The universe will continue to expand faster and faster (gravity unable to counteract the repulsive force of Dark Energy) and, many hundreds of billions of years from now, galaxies will drift so far apart they will lose sight of each other.

Ultimately, in hundreds of billions of years, due to lack of new star births, all the stars will fade or be consumed by black holes and the Universe will be a very dark place.

But who knows what new discovery will turn that scenario on its head? In other words, what will the next 100 years of cosmology reveal?

As a distinguished cosmologist famously said: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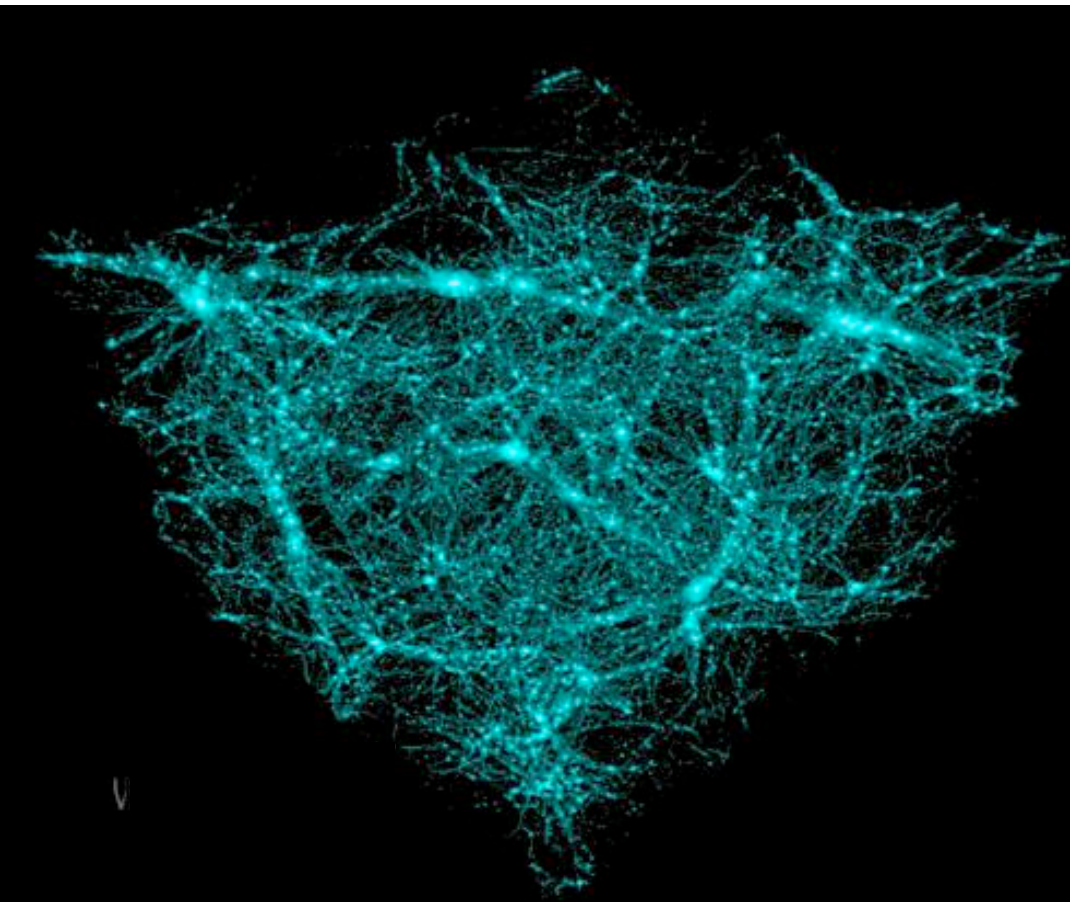
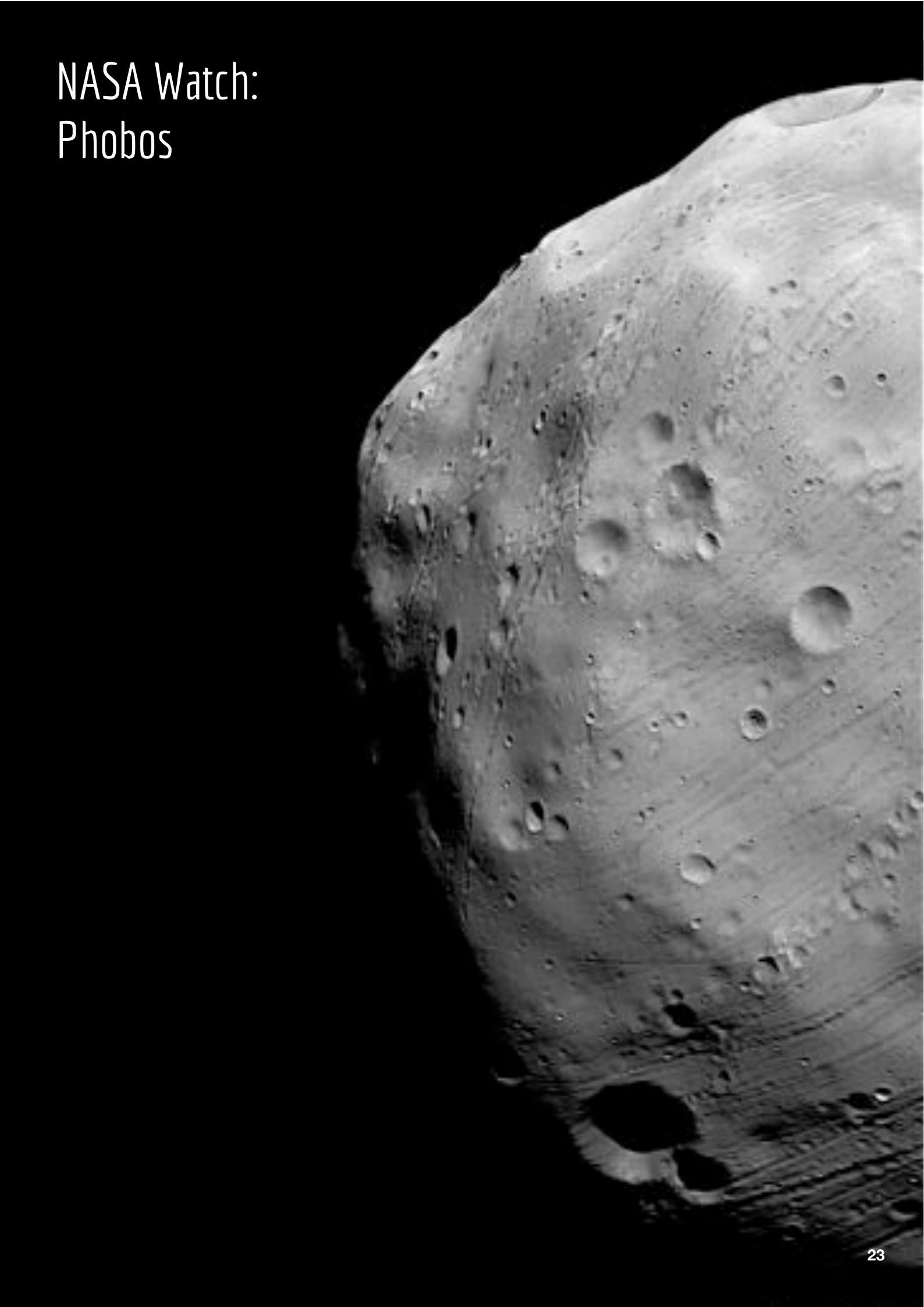


# NASA Watch: Phobos



The High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter took two images of the larger of Mars' two moons, Phobos, within 10 minutes of each other on March 23, 2008. This is the second, taken from a distance of about 5,800 kilometers (about 3,600 miles). The illuminated part of Phobos seen in the images is about 21 kilometers (13 miles) across.

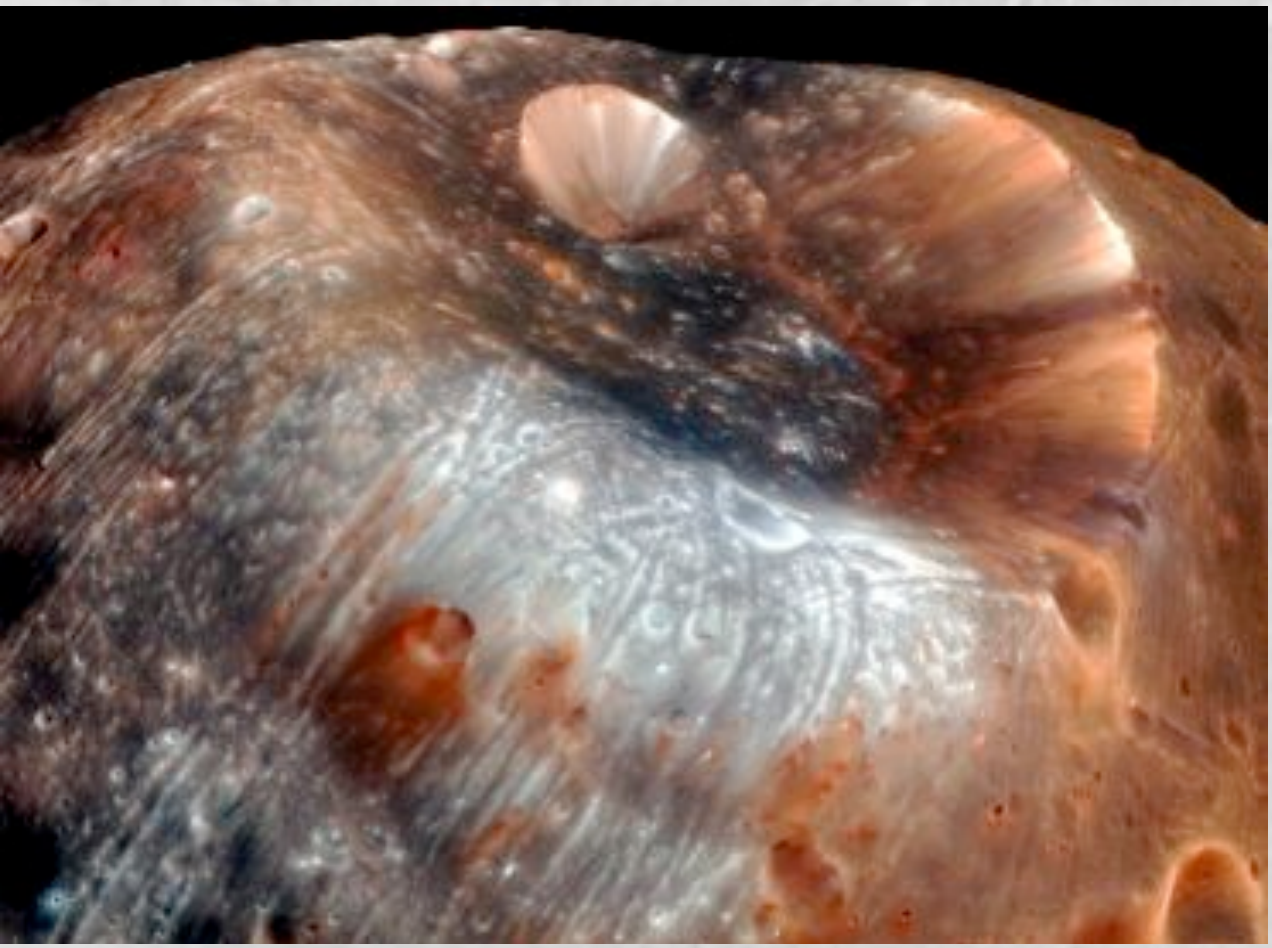
The most prominent feature in the images is the large crater Stickney. With a diameter of 9 kilometers (5.6 miles), it is the largest feature on Phobos. A series of troughs and crater chains is obvious on other parts of the moon. Although many appear radial to Stickney in this image, recent studies from the European Space Agency's Mars Express orbiter indicate that they are not related to Stickney. Instead, they may have formed when material ejected from impacts on Mars later collided with Phobos. The lineated textures on the walls of Stickney and other large craters are landslides formed from materials falling into the crater interiors in the weak Phobos gravity (less than one one-thousandth of the gravity on Earth).

In the full-resolution version of this image, a pixel encompasses 5.8 meters (19 feet), providing a resolution (smallest visible feature) of about 15 meters (about 50 feet). Previous pictures from NASA's Mars Global Surveyor are of slightly higher resolution, at 4 meters (13 feet) per pixel. However, the HiRISE images have higher signal-to-noise, making the new data some of the best ever for Phobos.

Although the main image here is displayed here in black and white, data from HiRISE's three color channels were used to give higher signal-to-noise, thereby increasing detail. The image is in the HiRISE catalog as PSP_007769_9015.

NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Mars Reconnaissance Orbiter for NASA's Science Mission Directorate, Washington. Lockheed Martin Space Systems, Denver, is the prime contractor for the project and built the spacecraft. The High Resolution Imaging Science Experiment is operated by the University of Arizona, Tucson, and the instrument was built by Ball Aerospace & Technologies Corp., Boulder, Colo.

Image Credits: NASA/JPL-Caltech/University of Arizona





ImageCredit: NASA

# ESO Watch:
# VISTA Views a Vast Ball of Stars - 9th May 2012

A new image of Messier 55 from ESO's VISTA infrared survey telescope shows tens of thousands of stars crowded together like a swarm of bees. Besides being packed into a relatively small space, these stars are also among the oldest in the Universe. Astronomers study Messier 55 and other ancient objects like it, called globular clusters, to learn how galaxies evolve and stars age.

Globular clusters are held together in a tight spherical shape by gravity. In Messier 55, the stars certainly do keep close company: approximately one hundred thousand stars are packed within a sphere with a diameter of only about 25 times the distance between the Sun and the nearest star system, Alpha Centauri.

About 160 globular clusters have been spotted encircling our galaxy, the Milky Way, mostly toward its bulging centre. The two latest discoveries, made using VISTA, were recently announced (eso1141). The largest galaxies can have thousands of these rich collections of stars in orbit around them.

Observations of globular clusters' stars reveal that they originated around the same time — more than 10 billion years ago — and from the same cloud of gas. As this formative period was just a few billion years after the Big Bang, nearly all of the gas on hand was the simplest, lightest and most common in the cosmos: hydrogen, along with some helium and much smaller amounts of heavier chemical elements such as oxygen and nitrogen.

Being made mostly from hydrogen distinguishes globular cluster residents from stars born in later eras, like our Sun, that are infused with heavier elements created in earlier generations of stars. The Sun lit up some 4.6 billion years ago, making it only about half as old as the elderly stars in most globular clusters. The chemical makeup of the cloud from which the Sun formed is reflected in the abundances of elements found throughout the Solar System — in asteroids, in the planets and in our own bodies.

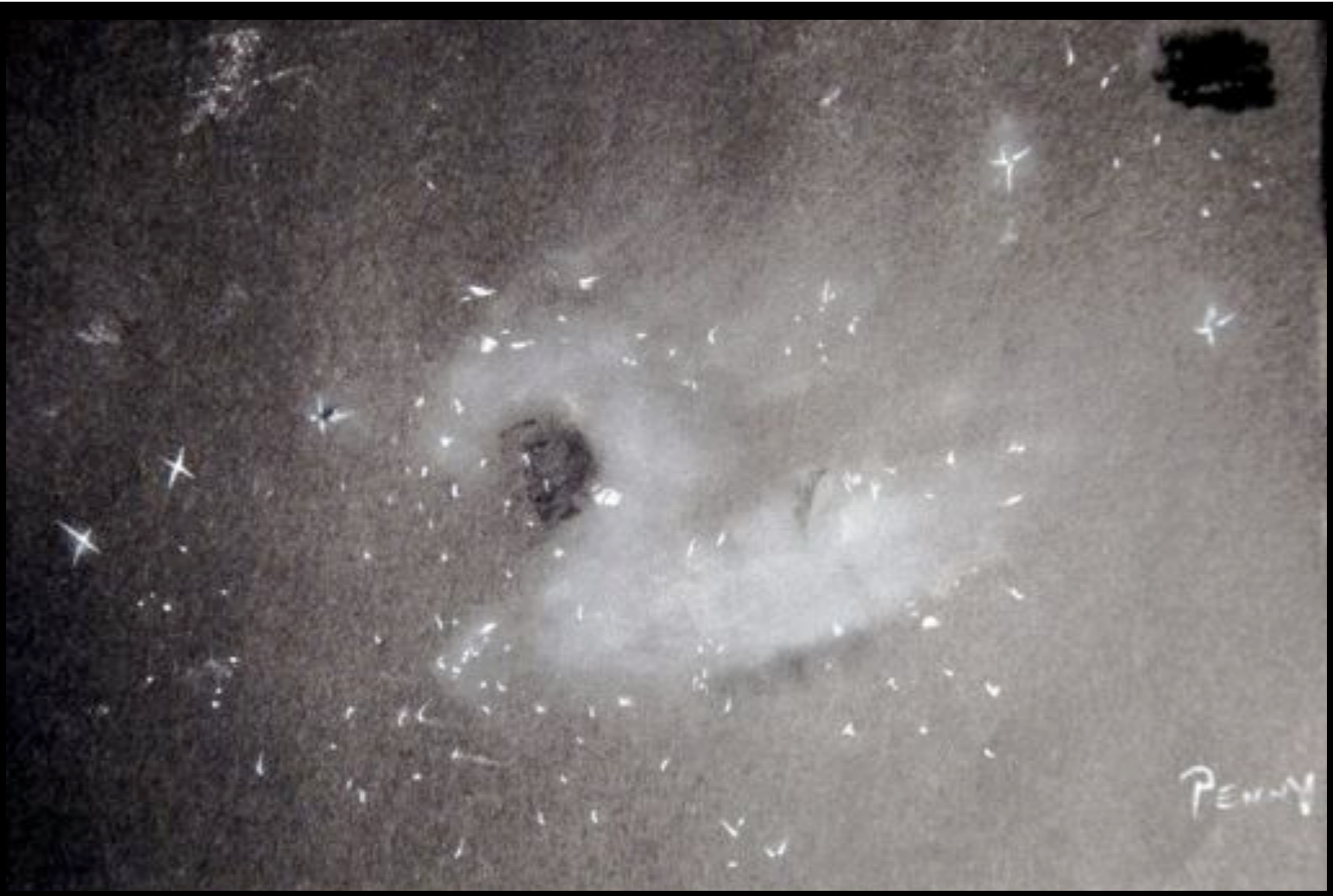
Sky watchers can find Messier 55 in the constellation of Sagittarius (The Archer). The notably large cluster appears nearly two-thirds the width of the full Moon, and is not at all difficult to see in a small telescope, even though it is located at a distance of about 17 000 light-years from Earth.

The French astronomer Nicolas Louis de Lacaille first documented the stellar grouping around 1752, and some 26 years later another French astronomer, Charles Messier, included the cluster as the 55th entry in his famous astronomical catalogue. The object is also cross-listed as NGC 6809 in the New General Catalogue, an often-cited and more extensive astronomical catalogue created in the late nineteenth century.

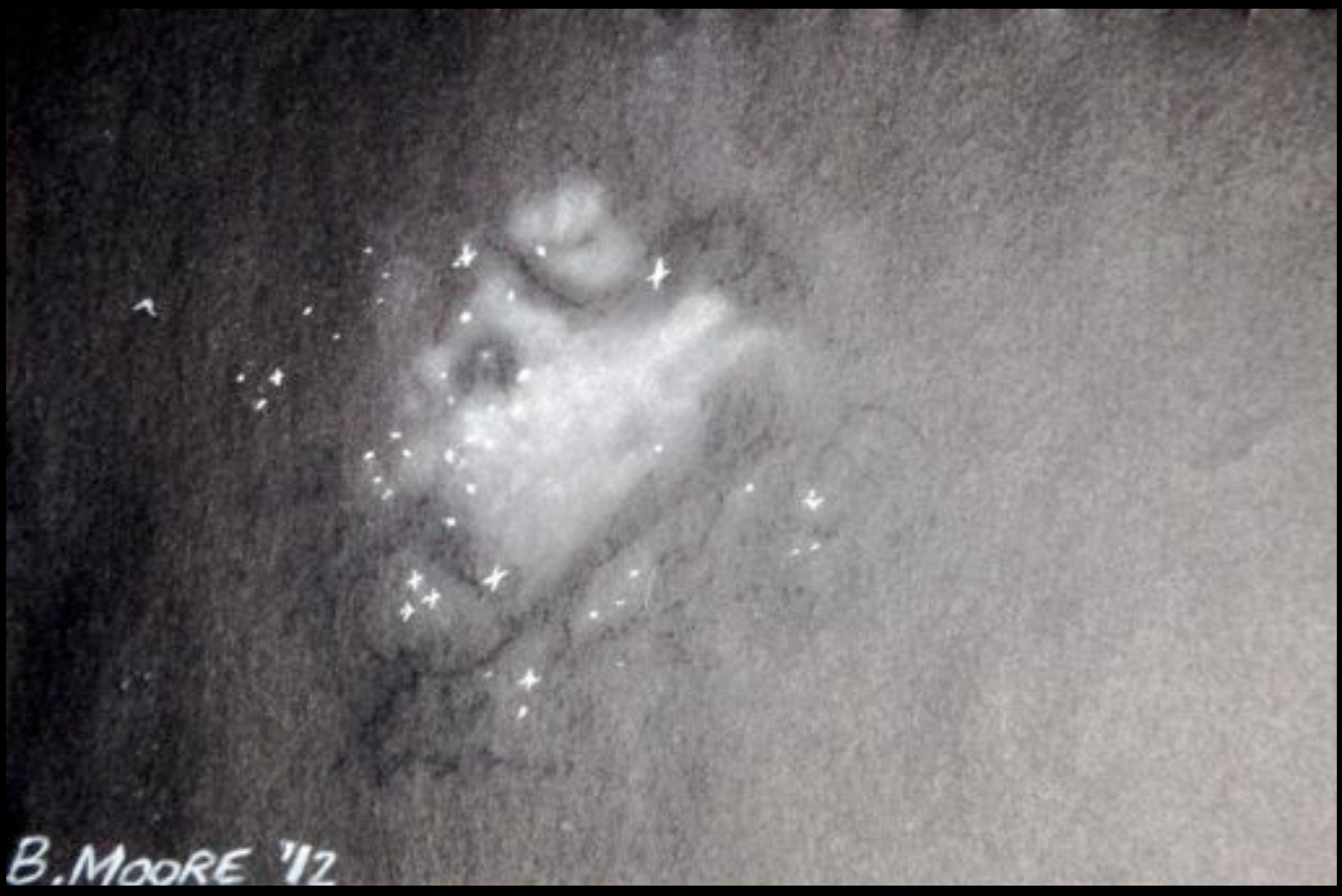
The new image was obtained in infrared light by the 4.1-metre Visible and Infrared Survey Telescope for Astronomy (VISTA, eso0949) at ESO's Paranal Observatory in northern Chile.

As well as the stars of Messier 55, this VISTA image also records many galaxies lying far beyond the cluster. A particularly prominent edge-on spiral galaxy appears to the upper right of the centre of the picture.

ImageCredit: ESO




M17 “Swan Nebula” Drawings



M17 “Swan Nebula” Drawings


M17 “Swan Nebula” Drawings

# Musings

Ursula Braatz

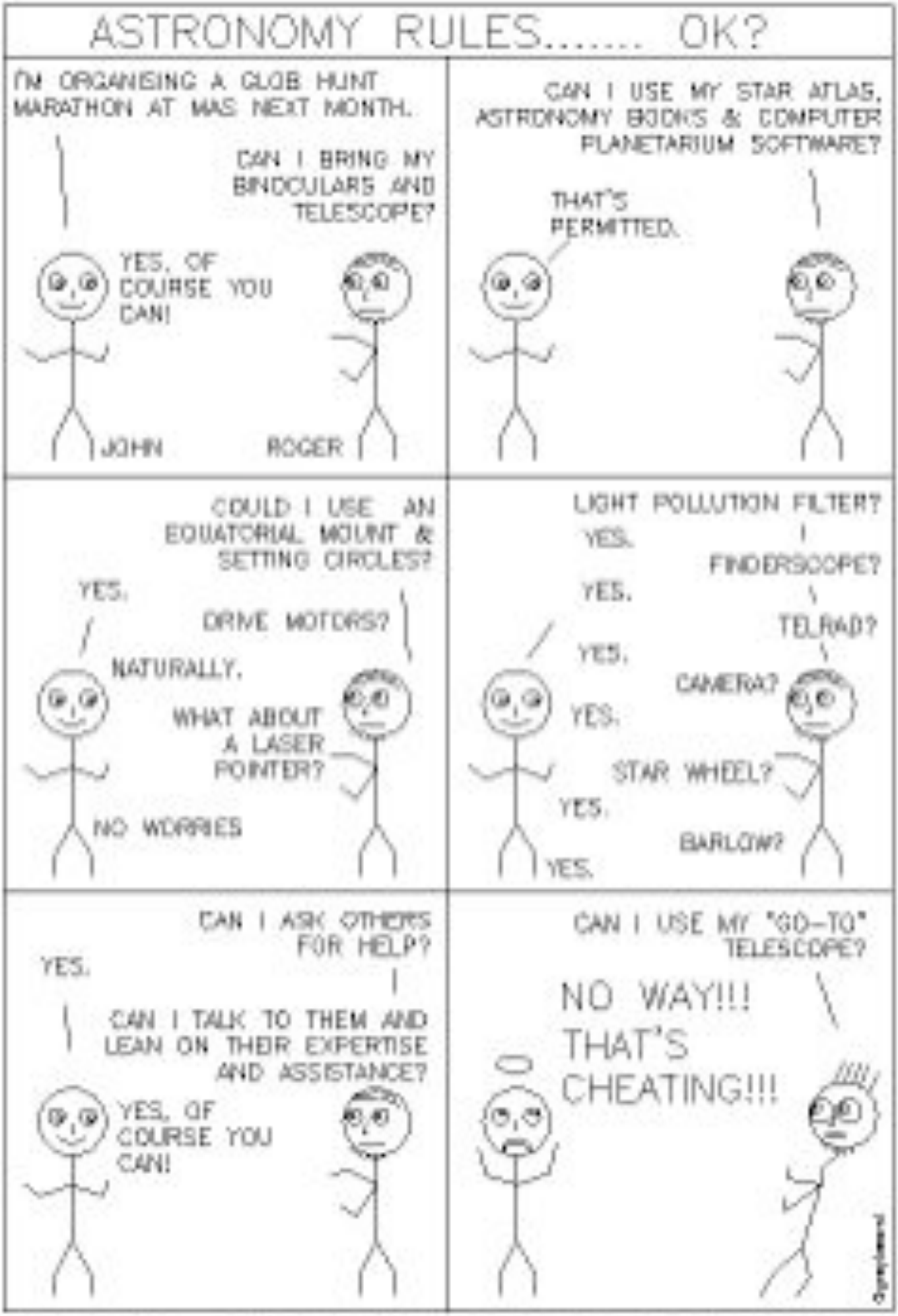
**What happened before the Big Bang?**

On Sunday, the 23rd of April I watched on TV SBS: “What happened before the Big Bang?”

Some scientists are convinced the Universe may have held life before the Big Bang some 14 billion years ago. What happened before this violent moment of creation is now being examined.

I always thought that there must have been something before the Big Bang. I did read, in an article from April 2011 in a German magazine “Spiegel online Nachrichten”, that stars of a discovered galaxy developed only 200 million years after the Big Bang. That was 13.5 billion years ago. In October 2010, they found a galaxy 13 billion years old.

I think it is possible with stronger telescopes that there can be found galaxies more than 14 billion years old, which developed before the Big Bang. Was there really a Big Bang or was it a big crunch? The big crunch came out of a crunch before. That is only a theory, or the Universe is a big black hole and there is always expanding and contraction. There may be multiverses, and multiple Universes are colliding together. I think with the colliding the galaxies will not be all be destroyed, so maybe there are galaxies from a Universe before ours?






Roger Powell

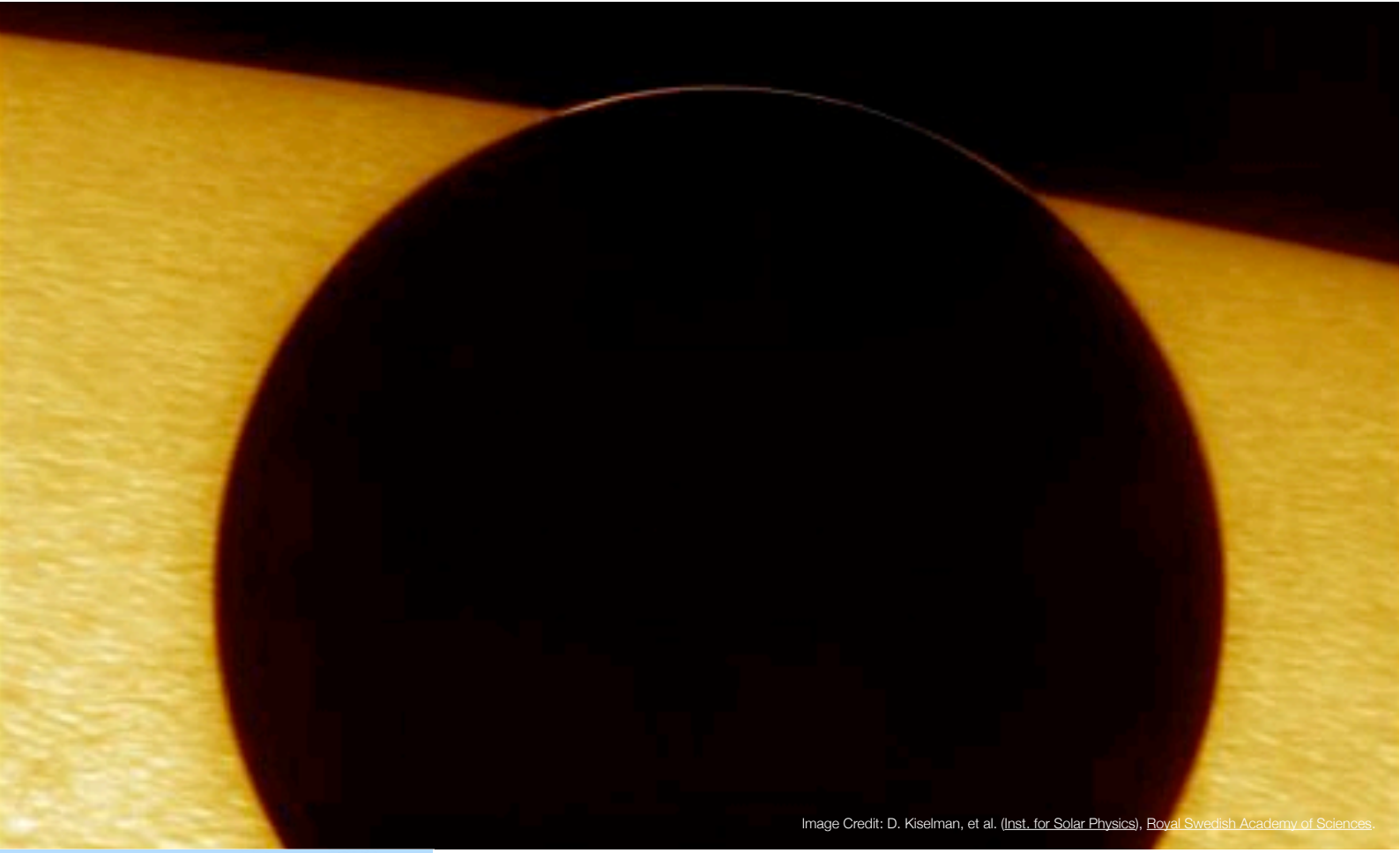


Image Credit: D. Kiselman, et al. (Inst. for Solar Physics), Royal Swedish Academy of Sciences.

macarthur astronomy forum

# prof. fred watson - april

## "in the face of the sun"

'Every so often, the planet Venus does something remarkable. Its orbit brings it to a point directly between the Sun and the Earth...'

When Venus passes directly between earth and the sun, we see the distant planet as a small dot gliding slowly across the face of the sun. We owe a great deal to this historically rare alignment with both the measurement of the size of our solar system and the discovery of Australia due to the study of this phenomenon. It was a "secret" mission that followed the 1769 transit of Venus that ordered the exploration of the South Pacific to find the legendary "unknown land of the South by Captain Cook. The last transit of Venus took place in 2004, however subsequent transits of Venus wont be viewable until December 2117 and December 2125.

With the backdrop of the Warrambungle Mountains, astronomical insights from Mount Stromlo Observatory, The 'Dish' and the Anglo Australian Telescope this "Macarthur Astronomy Forum" event will be one NOT to miss.

Professor Fred Watson, AM., from the Australian Astronomical Observatory is well known for his ability to deliver his material in such a way that you leave informed, entertained and smiling all the way home.

Bring your copy of one of his books for him to autograph for you, but we didn't tell you this… ;)

Warning: Prof. Watson may not still appear as photographed.

# heavens above!

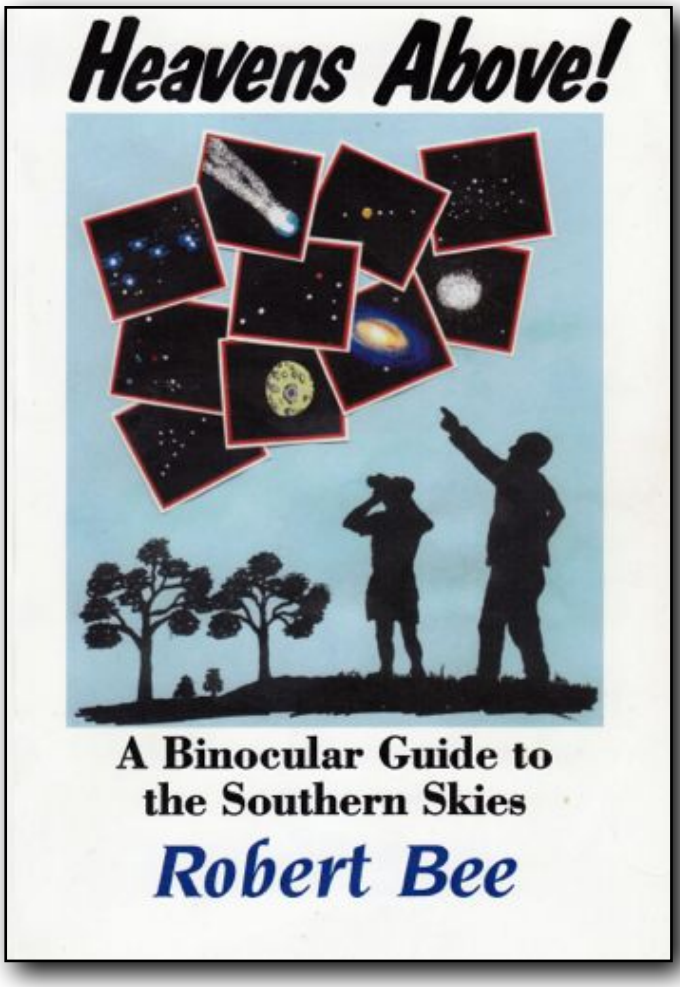
Advertisement

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.

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# 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: Barry Moore

# the forest

This must be the most under-utilised resource that MAS provides! It amazes us that so few visit but we 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 kangaroos 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.

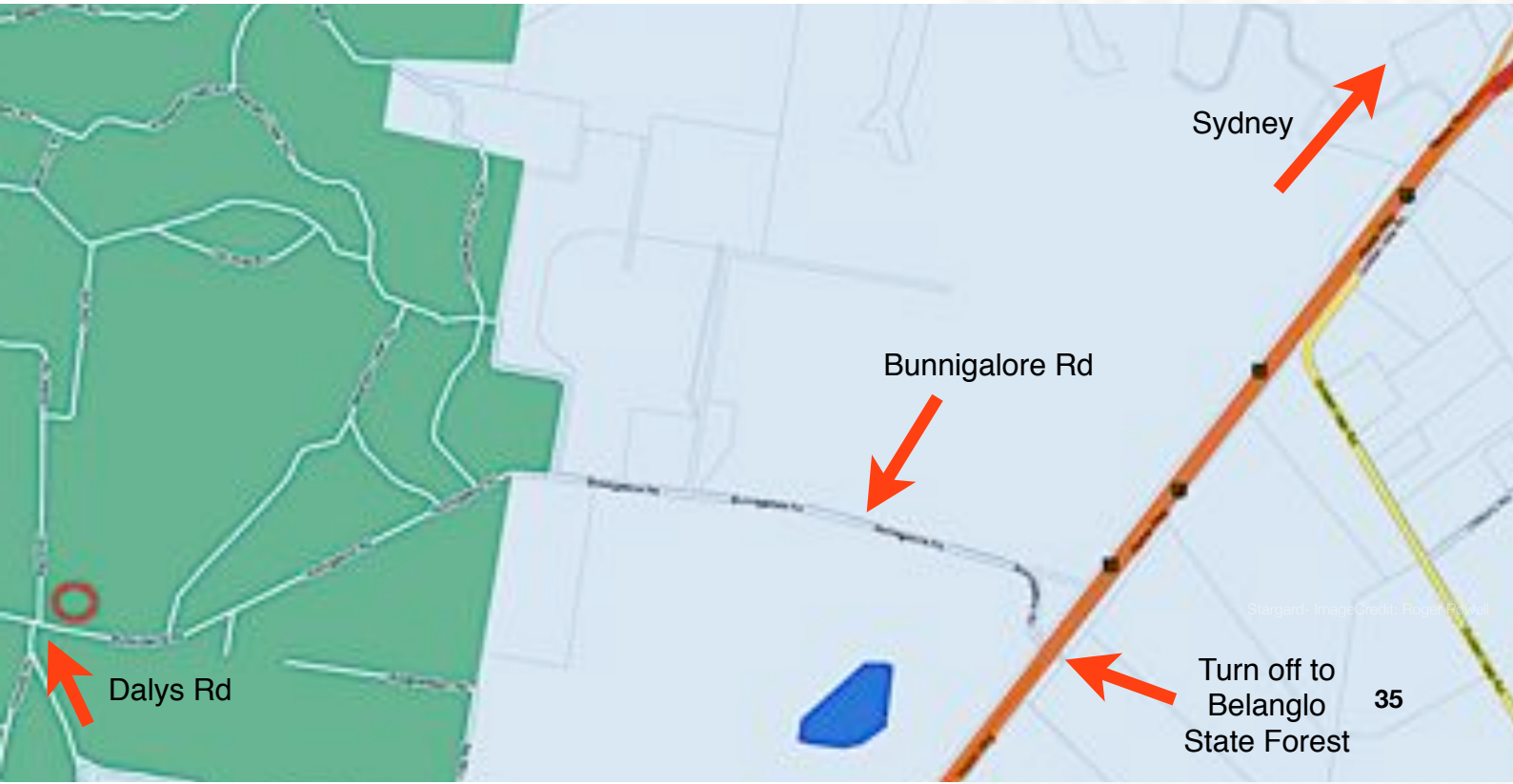
The nights are cool in summer and freezing in winter! Always ensure you have warm clothing with you and for those who intend to observe to the wee hours of the morning a freezer suit and boots is highly recommended.

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!



# M.A.S. HYSTERIA !!!

## PARTICLES FASTER THAN THE SPEED OF LIGHT???