

PRIME FOCUS

M A S O C I E T Y J O U R N A L

mas
macarthur
astronomical
society

Aug 2012

volume 17 issue 8

Dharawal
Image Credit: Chris Malikoff

from the editor's desk

Welcome to the August 2012 edition of Prime Focus - volume 17, edition 8.

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 August 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 August edition - our eighth for the year 2012.

Clear Skies!
Chris Malikoff

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CHRIS MALIKOFF

Schedule Planner

August-September 2012

Hello Members

First - A hugely warm "get well soon" message to Roger Powell, who has been hospitalised recently. He was partially replaced with a couple of updated parts, and news is that he'll be well enough to come to the Forum this month. We all wish you the very best Roger! :)

Mars! It may not be the first time that we humans have successfully lobbed something on to the surface of Mars and, as a machine, the Curiosity rover isn't radically different to anything that preceded it. It has wheels, a chassis, a few little cameras on sticks and a bunch of tasty little laboratories ready to do the taste test.

Well, that's not quite doing it justice. The thing has the overall dimensions and mass of a small car, not a billy cart. It's so big and heavy that it could not be wrapped in a few beach balls and simply bounced on to the surface like its predecessors were. Power is now provided by a nifty device called a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) which should keep it kicking along for a decade or two. Lots of oomph available for travel and science experiments now.

The team at JPL devised, executed and pulled off what I saw as the most unbelievably complex string of remotely-controlled events in our spaceflight history. Slowed by parachute after hitting a scorching entry interface, the heat shield was ejected. Radar monitored the blistering approach and triggered a set of step-throttled reaction rockets to slow the whole caboodle down to a hover twenty metres over the surface. A winch lowered the unfolding rover down to the surface on a synthetic rope while it hovered on these rockets. Once down safely, the winch disconnected and the descent stage took off again and committed suicide off to the side.

If you'd asked my opinion on the likelihood of success, I'd have been, well, skeptical. Congratulations JPL/NASA - you've re-ignited people's admiration for science in one hit!

Keep an eye out for information coming from our great "Dharawal Observatory" team. Things are starting to happen. Very, very exciting times.

There 's plenty on this month and next. Please make sure that you avail yourself, when able, to come along to our public nights and special events that MAS is known for in this region. We have nights with Fairvale High this coming Wednesday and host International House next weekend at the Forest. Please come along and lend a hand if you can.

At the Macarthur Astronomy Forum this month I'd like to welcome my friend and colleague Humayun Qureshi to MAS. "H" as he is affectionately known, is a guru when it comes to photography and cameras - both terrestrial and astrophotographic. Please welcome him, and he'll show you how amazing our world really is.

Clearest of skies!

Chris

DATE	EVENT	SUMMARY	TIMES
20 th Aug	MAS Forum	Building 21, Room 6 University of Western Sydney	7:30pm
22 nd Aug	School Event	Showing the night sky to 30 or so students at Fairvale High. Volunteers needed.	4:30 set up
25 th Aug	The Forest - International House	Members required to help host this traditional evening with the university students.	
8 th Sept	Stargard	Members Private Observing Night.	SS 17:44 MR 00:00
15 th Sept	Stargard	Globular Cluster Hunt	SS 17:48 MS 16:58
14 th 15 th September	The Forest	Members Private Observing Nights. \$15 per person per night.	SS 17:48 MS 15:55 SS 17:48 MS 16:58

JULY 2012
ANTHONY WESLEY

BY ROGER POWELL



Preliminary image captured by Anthony Wesley showing a black impact mark in Jupiter's South Polar Region.



This was Anthony Wesley's first visit to the Macarthur Astronomy Forum and welcoming an amateur astronomer (like us) to address us was refreshing. Anthony is a member of the Canberra Astronomical Society and observes regularly from his home observatory at Murrumbateman (between Canberra and Yass).

Unlike most of us, Anthony is a specialist astronomer. He concentrates on lunar and planetary imaging - Jupiter and Saturn in particular. He does it so well that he is world renowned for his Jupiter images and as Chris Malikoff said in his introduction, Anthony is one of the two best Jupiter imagers in the world.

Anthony's presentation to our Forum was a sumptuous viewing of his best personal images of Saturn and Jupiter, taken over the last four years. His glorious Jupiter images showed us how it's surface features changed over time, with spots and storms, coming and going, the South Equatorial Belt disappearing for twelve months and being replaced by a pale green belt (green is a rare colour on Jupiter) and then reappearing again last year.

He showed us images he took of a rare transit of Callisto and he showed us red spots, white spots and orange spots – many of the features that most of us might gloss over unless they are pointed out to us.

Most importantly Anthony showed us the black spot which he discovered on 19th July 2009, following an object impacting with Jupiter on the far side. This event is now generally known as the Wesley Impact. Apparently the Hubble Space Telescope was being serviced at the time but was then rushed back into use a month early to observe the impact site first discovered by Anthony. Wikipedia states that infra-red observation by Keck and the NASA Infra-red Telescope Facility at Mauna Kea showed a bright spot where the impact took place, indicating that the impact warmed a 190 million square km area of the lower atmosphere!

Anthony doesn't strike me as being an easily excitable type of person but he described how he contained his intense excitement upon realising the importance of the discovery he had just made. After informing NASA and reporting the discovery to other astronomers worldwide, he contemplated waking his wife to tell her about it. Wisely, he waited until breakfast time, when she said something along the lines of "That's nice, dear" and rushed off to work. Later in the day she (excitedly) called Anthony at home and exclaimed that his discovery was the main news item of the day. "I know," said Anthony, "The TV crews are all in the front garden!"

We were treated to numerous beautiful pictures of Saturn and some wonderful images of the recent white storm that encircled Saturn. His images showed Saturn with it's exquisite rings almost edge on in 2008 and progressing to the rings much wider as they are now in 2012. He told us that the rings are thirty per cent brighter at opposition but fade as the equinox approaches.

Apparently, the Cassini project does not routinely image Saturn for surface changes, it concentrates more on the rings and satellites. So it is not uncommon for Anthony to find a new storm feature before NASA does. Anthony e-mailed the Cassini team more than once to ask them if they had taken any images of particular new storms on Saturn and got the message back: "What storm?." Imagine that - NASA has this astonishing on-the-spot Cassini spacecraft imaging the Saturn system non-stop, yet they are unaware of major storms on the planet's surface until a NSW amateur astronomer lets them in on it!

This was a great presentation of some truly fabulous planetary images, personally presented by one of the most highly respected amateur planetary imaging specialists in the world. One of the advantages of specialising in planetary observing is that you don't need to worry about light pollution – just clouds!

Anthony's final advice to us was to look forward to 2017, when there will be a spectacular trinity of Mars, Jupiter and Saturn all coming to opposition at about the same time. I look forward to that!

This month: prepare to be absolutely astonished by the deep sky images taken and processed by Humayun Qureshi!

September: another visit by the amazing Professor Geraint Lewis!

Dhrarawal - images from the committee's recent visit to investigate the site's light properties.







John Rombi getting ready to show the public a few treats in the night sky.

Bob Bee with his 8" SCT at our public night at Dudley Chesham Sportsground



Macarthur dishes up some pretty spectacular storms from time to time! Images by Chris Malikoff



"The Zephyr Blows In"

Bob Bee

The hologram shimmered into focus. Admiral Sligon's wrinkled head floated before the Trifid Nebula and addressed a point above Agent 231's right shoulder. His message was short but full of dire consequences for the Alliance.

231 three pointed his cha mug into the recycling receptacle, then leaned back into the pilot's seat. "Why me, Admiral?" He scratched an itch in his left ear. "You know I'm heading home on leave to heal after that Orion disaster. Send 400. He's seen Zephyr."

The admiral's image exuded disapproval at the insolence. "Once too often, it would appear. 400 was terminated. Zephyr is still out there."

231 sprang upright. "400 gone? But...he was the best."

"Now you are, Gods help us! Or at least you're the closest." Sligon's face corrugated momentarily while 231's ship passed through an ion cloud. "You must stop Zephyr from passing those plans."

"Sure, I'll consult my list of fences for Mark V Starcruiser specs. That'll narrow the search to only one hundred planets." He attacked his ear with renewed vigour and a stylus.

"Brungella IV. You know..."

"I know it." 231 inspected the end of his stylus.

"Here are the coordinates on the third continent. The drop will be a trader's store in Quaggel. Contact's Haag Zweller, an expatriate Terran. He runs the conduit to the Drakkon."

"Does Zweller know Zephyr?" 231 mumbled around the stylus.

"No." The admiral had a pained look in his eyes.

"And just what am I looking for, Admiral? Or is that a secret too?"

"MagnoLiquid crystal. One litre. 512 Megabyte per millilitre. This could turn the war against us." Admiral Sligon jabbed a blunt finger out of the hologram. "And will you stop that!" "How do we know Zephyr's heading for Brungella IV?" 231 discarded his slovenly pose. He'd liked 400.

"We found a message plug in 400's ear. He must have suspected he'd been blown."

"Did you find any other messages on him? Any clues to Zephyr's current disguise?"

"We only found his ear."

"We only found his ear"? Come, good Master. Thou jesteth, surely?

Jesteth, young Francis? I am serious beyond dispute.

But such language offends our ears these modern times. That speech is bygone. Best...

Best you read on, ere your back bends my rod.

#

Haag Zweller was a nervous man. Since receiving the tight

band signal that a guest was arriving, "like a breath of fresh air," he'd felt sick in the stomach. He'd never met Zephyr, and was happy to leave it that way.

Zweller looked out the dirt streaked window of his store towards the jagged teeth of the purple mountains. The torrential downpour had stopped as suddenly as it had started. The suns came out from behind the fragmenting clouds and the Quaggel locals returned to their basking slabs. Youths played boisterously in the overflowing gutters, using their tails to splash laughing tourists who were of two minds whether to dodge the water or vid the natives at play.

Zweller realised he would miss Quaggel. But this would be his last assignment. He was getting too old and the game was becoming too dangerous. His predecessor had been executed by the Alliance. The Drakkon paid well but were becoming over-demanding. Now he had to deal with Zephyr. Time to get out.

The customer bell jangled and Zweller turned. A couple from Betelgeuse wedged their ovoid bodies through the door and approached the counter, narrowly avoiding merchandise on display shelves. The male activated his universal translator, jumped at the squeal of feedback, and adjusted the volume.

"Apologies, honourable storekeeper. You artless?"

"Pardon?" Zweller said.

"Your store without art. We must have. Shuttle arrive three hours." The male pointed at the roof and held up three fat fingers for emphasis.

"No. Store with art." Damn, thought Zweller. I'm beginning to talk like a translator. "In the next room." He pressed a buzzer on the counter. A side door opened and admitted a stooped Brungellian whose yellowing neck scales revealed the onset of old age.

"My assistant R'Gurraq will show you the gallery," Zweller smiled.

"Greatly thanking. Brungellian art all galaxy most sought."

As the tourists followed R'Gurraq, Zweller pondered the male's comment. A shuttle arriving in three hours? Maybe...

A piercing shriek, not unlike an elephant trumpeting, punctured his thoughts. The female Betelguesian lumbered from the gallery, her pudgy digits covering her eyes. Her blind passage sent numerous valuable souvenirs crashing, while the translator vainly fought to cope with the hysterical torrent. "Great Bete...horror...untranslatable expletive ...grievous fault... mutilation..."

Her mate approached, holding a long green object at arms length. Zweller's eyebrows rose. The male stood before Zweller, trembling, R'Gurraq's limp tail in his hands. "Apologies, profusely. Assistant tailless."

Zweller's cheekbones ached from barely controlled laughter. R'Gurraq's semiannual tail shedding had occurred at an undiplomatic moment. He took the tail. "Did you fancy any work, Bete-mahir?"

"Yours standard up to. Regret inferior but regards artisan Quull," the pedantic translator intoned from the retreating tourists.

Quull, thought Zweller, puzzled. That was the third time that day he'd heard the name. He determined to find out more. "R'Gurraq, I have something here of yours."

Trust not a dropping or drooping tail, I pray. It avails you not to drop if thou already droops.

Thou have more to contribute to the class, Francis? Or doth your bell sound hollowly from brains long forfeit?

**Good Master...(wise title, witless holder none the less)... I beseech your patience - for mine hath run dry.*

*Consent once more, to explain the purpose of this torture.**

In truth, your ignorance is torture enough. Persist, rapscallion, and allow enlightenment to be your salvation.

#

Artisan Quull Quillah was doing a brisk business. Since midday basking, he had sold four pieces. The Betelgeuse tourists had returned to his quarquam, agitated. Further inspection of Quull's display restored their normal tourist equilibrium.

"Quull artful," the male enthused. "Six days Quaggel search. Quull's quarquam then here not. Now is." He pointed to an exhibit in the corner. "That will take."

Oscillating liquids of gorgeous colours intertwined like mating snakes in midair. Though no walls contained them, they didn't mix. Their ever changing shapes exuded sensuality across planetary cultures. The magnetic field generator orchestrating the liquid ballet was artfully concealed.

"Regret not selling," Quull's translator hissed. "Special."

"Apologies, surely..." the male began to protest, then stopped as Quull stepped between him and the exhibit.

"Choose other." Quull's tail slowly swept the dirt floor.

Behind Quull, the female quietly approached the sculpture. Her hand reached out to touch a fluorescent green column of undulating liquid but was met by the tip of Quull's tail. She screamed, then rushed for the quarquam's flap. Her mate emitted a Betelgeuse curse and quickly followed. Artless!

Artless fartless!

WHACKKK!

Zounds, thou truckless ingrate. My prize rod asunder from thy back. How now to discipline thy unbridled disrespect?

My respect would boundless be, if modern texts we were to study. What gain we in delving this ancient space opera? How doth it befit us? 'The Zephyr Blows In'. Blows out, more's truth.

Such youthful wisdom who knoweth all. Continue thy reading, I pray, that thou should'st know more. Ancient to thee, classical to others. This work bringeth riches beyond price to our stagnating language.

Fie on...

Continue, I advise, lest my erstwhile rod be displaced by yon laser lance.

#



The shuttle detached from Brungella IV Interplanetary Terminus, falling towards the atmosphere, destination Quaggel, centre of the Brungellian art world. There was a full complement of passengers, mostly tourists who had travelled across the galactic sector to see,

and hopefully buy, the most prized of souvenirs.

"Though Brungella IV is a civilised and technological world," the hostess's translator recited, "the natives of Quaggel lead a much simpler, less affected life. Feel free to barter. Drink only in your hotel. And don't step on their tails."

Brant Prinz wasn't listening. Through his dark glasses, he scanned the other passengers, seeking any signs of recognition. He met the gaze of a middle aged matron who had been staring at him since dropoff. She whispered to her husband, then floated the three rows down the aisle.

"Brant? My gosh...it is you!" she squealed. "Would you sign my glove?" She pushed her plump hand under Prinz's nose.

"Of course. Who should I...?"

"Thelma! Oh, I loved you in Sunset over Bootes," she gushed.

Prinz flourished his stylus. "There you are, Thelma." He looked around, then whispered. "Don't tell anyone else who I am. I'm on holidays. You know." He lowered his glasses and winked.

Thelma fainted. The hostess floated her back to her seat and administered salts. The surrounding passengers smiled knowingly. It must be hard having a quiet holiday when your classically sculptured face is known in every cinerom across the Allied Sector.

Gilmog Fenn did not smile. Despite the zero-gee, he was engrossed in his accounts.

The Antarian beside him burped politely. "Not everyone's a tourist, it seems."

Fenn looked up with a start. His small filmy eyes stared at the Antarian from beneath impossibly shaggy eyebrows. "What..?"

The Antarian pointed at the books.

"Some of us have to earn a living," Fenn said. He looked resentfully across at Prinz.

"Selling what?"

Fenn opened his sample bag and produced a container of golden liquid. He held it up to the light, where it

coruscated like bottled fireworks.

The Antarian stared at it in awe and tried, without success, to read the exotic label. "What is it?" he finally asked.

From the corner of his eye, Fenn saw Brant Prinz glance in his direction. He quickly returned the bottle to his bag. "Booze."

Master, methinks...

Thou thinks at last. Forsooth, our cause, once giddy from starvation, may be fed yet.

Shall I read on?

Great Andronicus!. The reins are loosed.. Ride on, my hero.

#

231 stood opposite Zweller's store and watched, waiting. The trading post was in the centre of Quaggel. Eventually, all native artists came there to sell their major works. Similarly, all tourists came, either to buy, or savour what they couldn't afford.

231 had no idea how Zephyr would look or intended to pass the plans. But 231 had his own plan. He scratched an ear. It was time to act.

The bell jangled. R'Gurraq greeted Fenn, his incisors exuding cordiality. "Welcomes. Help I may?"

"On the contrary. I can help you." Fenn launched into his sales routine.

R'Gurraq, his tail stump waving patiently, listened politely, then suggested he fetch Haag Zweller. Fenn's reply caused a temporary short in R'Gurraq's translator.

Fenn repeated his presentation to Zweller. From a variety of miniature sample bottles, Zweller took a sip of an iridescent blue liqueur. His eyes bulged as he gasped for breath.

"Tends to put the wind up you, eh?" Fenn said.

Zweller paused midcough. He looked intently at Fenn. "Do you have anything else?"

Fenn reached into the depths of his bag. The golden fireworks were in his hand when the door bell rang. Zweller cursed and Fenn turned to see the source of the interruption.

"I must with you speak, Master Zweller," Quull Quillah said.

"Return later. I have business." Zweller allowed his irritation to translate.

"Wait it cannot," Quull insisted.

Fenn hesitated, returned the container to his bag, then headed for the door. "Keep the samples. I'll come later with the real thing."

As the door jangled shut, Zweller turned to Quull impatiently.

"My fiery intestines sell you will?" Quull asked.

#

Quull Quillah basked on his slab outside his quarquam. It was midday and Brungella's red dwarf mate was kissing the mountains. Quull was feeling satisfied. His major work was safely located in Zweller's store, its field active.

With one eye, Quull looked across the muddy street to the opposite walkway. Fenn, sample bag firmly grasped, was weaving through a throng of tourists who were vidding basking Brungellians. He almost tripped over a discarded tail, recovered quickly and hurried on.

A furtive movement caught Quull's other eye. A man was progressing from window to window, a half block behind Fenn. He pretended to examine the stores' contents, but regularly checked Fenn's whereabouts. Quull's eye telescoped. Despite the gaudy tourist apparel, Quull immediately recognised Brant Prinz. He puzzled the matter a moment. The cine-star was covertly stalking Fenn. But why? As he followed each man's progress, he reached a conclusion. Smiling, he decided to pay Gilmog Fenn a visit that evening.

Enough, young Francis. A surfeit of wisdom is unwise lest easily digested. Else thou vomit it forth, wasting all.

But Master, now I understand...

I rejoice. But the present is ended. Master Orlando awaits, more quarking tensors to bore you with, no doubt. The ultimate chapter of this classic will wait for the morrow. Begone.

#

Zweller watched the 'fiery intestines', mesmerised. The bizarre image given by his translator had stuck in his mind. The writhing columns of magnetically suspended liquids were an artistic masterpiece. He had convinced Quull to leave his magnosculpture in the store. It would gain greater exposure to tourists there than in Quull's quarquam.

Or had Quull convinced him?

Momentarily, the sculpture took the shape of lanyards blowing in a breeze. Zephyr! Where was he? When would

he pass the plans?

The door announced a customer. Zweller instantly identified the cinestar Brant Prinz. Good, a wealthy customer without taste. "Something for Prinztown, sir?"

"Great gods, am I that easily recognised in these backwoods?"

"Do Drakkons have four eyes?" Zweller laughed.

Prinz's reply was cut off by the door bell as Quull Quillah entered.

"Permission to browse?" Prinz asked.

Zweller absently nodded and pointed towards the gallery. "My assistant R'Gurraq will help you." Then he turned to Quull who had approached his sculpture and exposed the field generator. What's he up to?

"Intrusion to pardon. Adjustment may I?"

Reassured, Zweller shrugged indifference and began tidying shelves, waiting for Prinz's return with a purchase.

A sudden downpour made the roof drum and the air filled with rich Quaggel smells. Scurrying footsteps approached, then passed the store. Ponderous silence hung from the ceiling. Zweller's hackles rose with a premonition that events were about to unfold. He discreetly checked the charge on the weapon beneath the counter. Footsteps stopped outside.

The door opened and Gilmog Fenn entered, drenched from the tropical rain. His squinting eyes took in Quull bent over his sculpture, Zweller at the counter, and the otherwise empty store.

"I promised the real thing. Here it is." He strode past Quull while removing the flask of golden liquid from his bag. He placed it on the counter.

Zweller looked intently at Fenn, then at the flask. Relief passed over him. He almost laughed. As simple as that, he thought. His relief quickly turned to puzzlement as the contents of the bottle began to swirl, then churn violently. Energy scintillated within the liquid, ricocheting off invisible barriers, threatening to shatter the container.

"What...?" Zweller looked at Fenn who was staring aghast at the bottle, his eyes popping from their bushy sockets.

"Move nobody!" R'Gurraq stood proudly erect inside the gallery door, his hand blaster pointed unerringly between Fenn and Zweller. He glanced briefly at Quull, who was standing motionless beside his sculpture.

Zweller blustered. "R'Gurraq, what in twin suns are you..?"

"Traitor," R'Gurraq hissed. "You are more than a tail about to lose ." He stepped forward and picked up the bottle. Its contents continued to swarm like tortured fireflies.

Fenn snapped out of his shock. "Who are you?" he asked R'Gurraq. He turned on Zweller. "What's going on? What happened to my Golden Aurora?"

"Don't play me for a fool, Zephyr." Zweller spat. He knew his trial and execution were imminent. "You blew it... and me."

Fenn turned sharply towards R'Gurraq, his hands open, pleading. "What's this madman talking about. Who's this Zeph...?"

Fenn's head dissolved in a pink spray.

Zweller looked at his faintly glowing blaster, then at Fenn's crumpled remains. "Frankly, Zephyr, I expected something more subtle from you." He glanced at R'Gurraq. "Mind the store, won't you?" Then Zweller embraced his weapon and blew a hole in his chest.

What say you, Francis? Do not ancient pages and dormant speech enlighten us in these modern days? Though generations by hundreds mould in their graves since these words were penned, they have a hoary lesson to tell.

I can but defer to your wisdom, Master, and pray your forgiveness for my early folly.

All is forgiven, while all will be revealed as you read the final pages.

#

R'Gurraq shook his head. So this was how it ends. The anonymous tip about the resonating bottle had been right. His long assignment spying on Zweller was over. Pity he couldn't have taken Zephyr in. Back to processing signals at the local Brungellian bureau.

"Artisan Quull." R'Gurraq remembered the other Brungellian. No need to get an innocent local involved. "Your exhibit, take and go."

Quull reached down and switched off the field generator. The liquids collapsed into the containing bund and lay still. He picked up the device, looked at the leaking corpses, and without a word, walked towards the door. Quull stopped at the threshold as Brant Prinz spoke from inside the gallery.

"Agent R'Gurraq, a word with you please," Prinz said.

R'Gurraq pocketed his blaster and entered the gallery, the now dormant bottle in his hand. He noted the cinestar's bearing had altered. In place of egotistical shallowness, there was a calmness, a self assurance. Confidence of command.

"Regretted violence, Mr Prinz. Matters of Alliance security."

Prinz waved away the apology. "When dealing with slime, hands get dirty." He produced a slate and stylus, keyed a combination, then showed R'Gurraq the display. "Admiral Sligon's Alpha Unit. Old Iron Pants will hear of your action." Prinz held out his hand. "When I return the plans."

Quull had moved silently from the front door to stand outside the gallery entrance. He listened to Prinz, hatred curling his lips back from saurian teeth. Barely breathing, he placed his artwork on the floor.

"Certainly, colleague. Too hot this one." R'Gurraq hesitated. "Understanding, surely. But...password?"

Prinz grinned. "Just as well, or you'd be on report. After you?"

"From Aries to Pisces..." R'Gurraq intoned.

Prinz caught a glimpse of Quull through the doorway. "Here, I'll write it," he said. "Artists have ears." He took the stylus from the slate and twisted its top.

In a blur of motion, Quull darted his tail into the control box and triggered the field generator. Prinz gave a start as the magnoliquids sprang into life. With a grim smile, he thumbed the stylus. R'Gurraq, confused by the sudden charge in the air, reached for his blaster.

Quull's foot gave the bund a powerful shove and the writhing columns slid along the floor to stop between R'Gurraq and Prinz.

The bottle in R'Gurraq's hand repeated its earlier display of energetic convulsions, while Prinz's long hair stood up as if electrified. A hum slid painfully upwards through five octaves. Over the ringing in his ears, R'Gurraq heard a cry from his boot camp training days. "Incoming!"

R'Gurraq hit the floor a millisecond before the disrupter stylus Prinz had aimed at his heart resonated beyond its design tolerance and disintegrated with a stunning detonation.

A minute of ringing silence passed. R'Gurraq slowly regained his senses. He shook his head, trying to focus. Everything before him was a red blur. Then he realised his vision wasn't at fault. It was Prinz.

The bottle lay on the floor, amazingly undamaged. R'Gurraq, still in shock, stood unsteadily and picked it up. Suddenly remembering Quull, he turned and fumbled to draw his blaster.

Quull grinned humourlessly, displayed his empty hands and walked to where the only recognisable part of Prinz lay. He reached down and carefully removed the flesh mask from the head, revealing two extra eyes. Drakkon!

"I regret Zephyr was a better actor than the real...late Brant Prinz."

"And Fenn..?" R'Gurraq glanced at the salesman's corpse.

"Wrong place...wrong time...wrong bottle, courtesy of Zephyr." Quull reached out to take the plans. "Admiral Sligon presents his compliments."

"From Aries to Pisces..." R'Gurraq insisted.

"...there's no place like home," Quull completed.

R'Gurraq handed 231 the bottle. "It was done well."

"It had to be. For 400."

As oft as I read it, still he dies.

And so it shall ever remain, young Francis. But not, I say, in vain.

The base Zephyr-killers...

...shall suffer still, as their conquered ancestors since the treachery of Quull Quillah 231. Peace and acceptance shall be refused them. Perpetual persecution their prize. Outcasts forever marked with the curse of the Fiery Intestines.

The skulking Zephyr virus, Master, incursed and incubating in the Golden Aurora, restored to the Alliance...

...a veritable flotilla of Starcruisers...

...Mark V...

...scuttling to glorious defeat.

And we will continue to study this ancient account...

...a testimony to Man's treachery...

...and Zephyr's sacrifice.

I aver it, Francis, on my dam's four eyes.

"in a flat spin"

Part 8 - Proving It

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

Nullius in verba: "Take nobody's word for it" - was the maxim adopted by the Royal Society (RS). First formed in 1660 - the Royal Society is today based at 6-9 Carlton House Terrace, London UK. Its motto reflected the founder's resolve to establish facts via experiments and to profess objective science ignoring the influence of politics or religion.

Whether that same resolve is applicable to the RS nowadays is a contentious issue. Science, nevertheless, still seeks those same empirical facts today, as we probe even deeper into an apparently ever-expanding universe. In its turn, the public are continually astonished at the unanticipated discoveries being made. The enormous amount of data amassed is about to explode with projects such as the Square Kilometre Array (SKA), and advances in orbital observation techniques, coming on-line; so much so, it can now be difficult to separate science fiction from science fact!

As discussed last month, the movements of the universe are almost certainly driven by opposing forces - so far mentioned are dark energy and gravity. A major generator of that nebulous, and perhaps little understood, force - gravity - is likely to be the cosmic phenomena we call - a black hole. Whilst gravity itself may not be fully understood, mathematically at least, the properties of gravity are regularly employed very accurately. That mathematical knowledge provides a means to

express, theoretical formulae, which leads to the development of some very interesting scientific hypotheses.

One of the many tools used today to assist in confirming such theories is the European Space Agency's (ESA) X-ray Multi-Mirror Mission (XMM-Newton). This satellite, launched on December 10th, 1999, is described as the 'second cornerstone' of the Horizon 2000 Science Program. The vehicle carries three high throughput X-ray telescopes, with an exceptionally efficient area coverage, and an optical monitor (the first flown on an X-ray observatory). Because Earth's atmosphere blocks out all X-rays, it is only possible to detect and study X-rays that emanate from space using an orbital telescope of this nature.

An article, posted by the Goddard Space Flight Centre - Tuesday June 5th, 2012 - reveals how an international team of astronomers - using data from the ESA - XMM-Newton satellite, has identified a long searched for X-ray 'echo' that will possibly offer a new way to investigate super-sized black holes in far-flung galaxies.

The article outlines how 'most' big galaxies host a massive central black hole, containing millions of times our Sun's mass. As matter streams toward the central black hole, the galaxy's centre lights up - emitting billions of times more energy than the Sun. Astronomers have monitored such 'active galactic

'Nullius in verba'

nuclei' (AGN) for many years, in an effort to better comprehend what actually occurs on the threshold of such super-massive black holes.

The source of the X-ray 'echo' was identified as coming from the galaxy NGC 4151 or Eye of Sauron - located some 43 to 45 million light years away, in the constellation Canes Venatici. Astronomers believe the galaxy's active nucleus is powered by a black hole weighing 50 million solar masses; compare this to estimates of the Milky Way's (not so) supermassive black hole, which might be as large as 4 million solar masses! After analyzing data from NGC 4151 and revealing numerous X-ray echoes, researchers demonstrated for the first time the reality of relativistic reverberation. Simply put - the data seems to support yet another aspect of Einstein's Theory of Relativity in relation to 'echoes' - or ripples in space - emanating from such X-ray sources as black holes - as originally hypothesized by Einstein, circa 1905.

Another of these X-ray orbital telescopes is the Chandra observatory. The Chandra's high-Earth orbit ranges from 16,000 km to 133,000 km - or more than a third of the way to the Moon!

The telescope takes 64 hours and 18 minutes to complete its incredible elliptical course. The main advantage of such a huge range is that it allows longer observation times to be accomplished, up to 52 hours; much longer than can be attained by ordinary low-orbit satellites.

Chandra's list of discoveries to date is astonishing - but I should add - it is of course only one among many scientific space projects going on around the world at this time. Nevertheless, in the area of deep space activity - Chandra's achievements make impressive reading. Most notable perhaps, is Chandra's ability to squeeze more information from known space objects - objects previously considered worthless and fully explored. Not for the first time, scientists have been forced to rethink their approach. Now, by studying an object's X-ray emissions, astronomers have been

able to gain further insights that relate not only to an object's existence and development, but also to its surrounding cosmic environment. A prime example of this is the supernova remnant RCW 86 - (aka SN 185) first observed by Chinese astronomers 2000 years ago, in 185 AD. At that time Chinese observers recorded the appearance of a baffling 'guest star' which had materialized in their night sky and remained visible for approximately eight months.

Readers should also note, this particular 'Chandra observation' is another excellent example of joint cooperation between a range of orbital equipment: Chandra, XMM-Newton, Spitzer, and WISE. The new data gathered about this 2000 year old mystery, showed RCW 86 to be the result of a Type 1a supernova explosion; the type of supernova that occurs when a White Dwarf pulls matter from an attendant star until a thermonuclear reaction happens. In addition to this, it was found that supernova remnants also acted as extremely efficient 'natural particle accelerators'. For more information on this and other Chandra discoveries see: <http://www.nasa.gov/centers/marshall/news/>



[news/releases/2003/03-158.html](http://www.nasa.gov/centers/marshall/news/releases/2003/03-158.html)

Another recent paper, dated June 4th, 2012, reports on the possibility of 'rogue black holes wandering the universe'. (sic) Setting aside the obviously hyped-up title, the prospect of such an event occurring is quite professionally reported. Astronomers, using the Chandra X-ray observatory, have been focusing on a system known as CID-42, located in the centre of a galaxy, about 4 billion light years distant. Here they discovered firm indications of a massive black hole seemingly being ejected from within the system. Initial observations appear to show the ejection speed at several million kilometres

per hour. The estimated speed seemed a little vague to me, as did a few of the other details. Nevertheless, the phenomenon was identified as being 'a recoiled black hole', which, it was explained: happens due to a gravitational wave 'kick' from the merger of two black holes. (sic)

Poetic license is exercised partway through the article with the statement that whilst the event is possibly quite rare, it could mean there could be giant black holes roving unobserved in the infinite spaces between galaxies. Stating the obvious, the author says such objects would be invisible to us - because they have consumed all of the gas that originally surrounded them after being ejected from their home galaxy.

Not for the first time, our simple human credulity is tested to the limit when faced with the possibility of an object, that in all probability weighs millions of times the mass of our Sun can be moved - let alone expelled at great velocity from its original location. Even the possibility serves to remind us of the mind-boggling power such colossal gravitational forces have to influence cosmic fluctuations.

Coincidentally, the article reveals that new data gathered from these observations uphold yet another aspect of Einstein's Theory of Relativity, as detailed below:

Einstein's equations are so complex they were only able to be explained accurately a few years ago for a fairly uncomplicated system of two black holes in a tied orbit. A simple system such as this, occurs in nature as a product of a union between two galaxies, each having a single black hole at its centre.

The exact key to Einstein's equations, achieved with complicated computer algorithms, demonstrated that the two black holes merged into a single black hole which was driven in a preferred course like a rocket, due to the directional discharge of gravitational waves. These gravitational waves acted as the material blasting from a rocket exhaust.

The conclusions then drawn are that if this was indeed the cause behind the observed recoiled black hole, the data presented the first empirical evidence in support of Einstein's equations in the unknown regime of dynamical strong gravity. Again, collaboration with other sources proved vital; additional data from the Magellan and Very Large Telescopes in Chile, suggested that the two objects

in CID-42, are separating at a speed of no less than 5 million km per hour.

The physics involved in such events are well beyond the ken of mere mortals, such as yours truly. Nevertheless, over a hundred years since Einstein first posited his ideas on a chalkboard, with major advances in astronomical and scientific hardware, scientists now appear to be proving many of those long held theories to be correct.

To be continued...

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CLUBSINGULARITY... an astronomical drama

Bob Bee

On Friday 27th July I attended a 'work in progress' performance of Theatre Kantanka's latest production 'Clubsingularity' at the Campbelltown Art Centre. It was a singular experience.

MAS had received an invitation in response to its assistance to the group's research at our Magnitude II exhibition. A kind of quid pro quo, but really a gesture of sincere thanks.

When I arrived at the Art Centre, I was given a very warm welcome by its Productions Curator Annemaree Dalziel. Unfortunately Chris Malikoff had been held up by work commitments and I was the sole MAS representative there. I felt a bit like a fish out of water with all the other 'art' types there but was made to feel very welcome.

The performance was in the small theatre, very much an 'intimate theatre' experience. There were five performers on stage (three women, two men) and technical support (sound, light) to the side but still part of the 'action'.

What was it about? Well, you had to be there to appreciate it. The following description doesn't really do it justice.

Imagine a gathering in a club – a cross between a night club and a social club. More of a social club really, with a bar and stage acts. But rather than tennis, bowls, bingo or singles, the connecting theme/activity of its members has to do with debating astronomy, cosmology and quantum physics. You know, the normal stuff. And not just debating it but 'experiencing' it. The occasional dust up between ladies over the question of "was there a 'before' the Big Bang?" An astronomical version of Musical Chairs. A trivia quiz on cosmology after too many drinks and many more quirky carry ons. Like I said – you had to be there.

After the performance, there was mixing with the cast over drinks and nibbles. I enjoyed a conversation with three of the cast, including Katia Molino who played the stuff shirt "cosmology geek" in the show. Katia had clearly done her homework on the show's subject and we had a very lively chat about cosmology. It was like a poker game – I bid *Dark Matter*, I'll raise you *Dark Energy*, I'll raise you *Inflation*, I'll see your inflation and raise you *Roger Penrose*. Great fun.

Theatre Kantanka is hoping for more Arts funding to allow the Clubsingularity production to be polished and then produced elsewhere. They will advise MAS when this happens and we will most certainly receive invitations to attend. When this happens, my suggestion is 'Go!' You will enjoy it.





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 Wednesday 4th September 18.00

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

Depart: Honolulu Wednesday 4th September 11.48

Arrive: Hilo Wednesday 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/>

Friday 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 7th and Sunday 8th 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 1 hour @ \$230.00. See <http://www.hawaiiactive.com/activities/bigisland-paradise-helicopter.html>

Depart: Hilo Tuesday 10th September 13.18

Arrive: Honolulu Tuesday 10th September 12.07

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

Wednesday 11th: Pearl Harbour, Arizona, Missouri etc \$70.00

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

Friday 13th: Shopping/sightseeing in Honolulu/Waikiki

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

Arrive: Sydney Sunday 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.

Musings...

Hi, my name is Phillip Ainsworth, and I am an amateur astronomer. I have only lived at Spring Hill for three months, but I find the skies so clear and magnificent I feel I must write my observations down.

Most nights I am home, I gather my deck chair, thermostat, thermal jacket, beanie, etc; and look forward to a night of wonder & stellar viewing. The first night I decided I would brave the cold in July, I was amazed at the plethora of stars and was quickly absorbed by the immensity of the dark skies you have out here - nothing like this in Campbelltown unless one drives out two hours away from the lights.

I was hoping to write some articles for your newspaper - to aid the average person who occasionally looks up into the night sky and wonders what they may be looking at. I have written for the Camden Crier on astronomical material, space articles for the international National Space Society magazines, and have been President & Vice President of those societies. I currently write for a local astronomy newsletter in Campbelltown, Prime Focus and a paranormal newsletter also in Campbelltown called The Phenomenon Times. I am hoping to break into the writers' circle here, and will write on either subjects relating to paranormal happenings or astronomical or both if required.

My other interests include Page Turners, ie; reading, writing, sport, local events, and follow most sports from women's netball to AFL, ARL, rugby, etc; and would be willing to write for you on those topics as well if needed.

The Macarthur Chronicle in the Campbelltown region started up a column profiling a community member each fortnight on some achievement he/she has made over the years, or if they just want to have a say to start up a group in the local area. I would love to be able to start something like that up here in the Central West region.

Thank you for your time and considering my request, I look forward to hearing from you in the near future.

Phillip Ainsworth

Holiday in the Whitsundays.

We are on holiday in the Whitsundays, now, like every year. We left home on the 7th of July and stopped in Coonabarabran, Moree, Taroom and Sea View. We arrived on the 11th of July here in Cannonvale in the "Seabreeze" Caravan Park, only 3km from Airlie Beach. I want to do something in astronomy, and brought my laptop and printer with me to write something for Prime Focus.

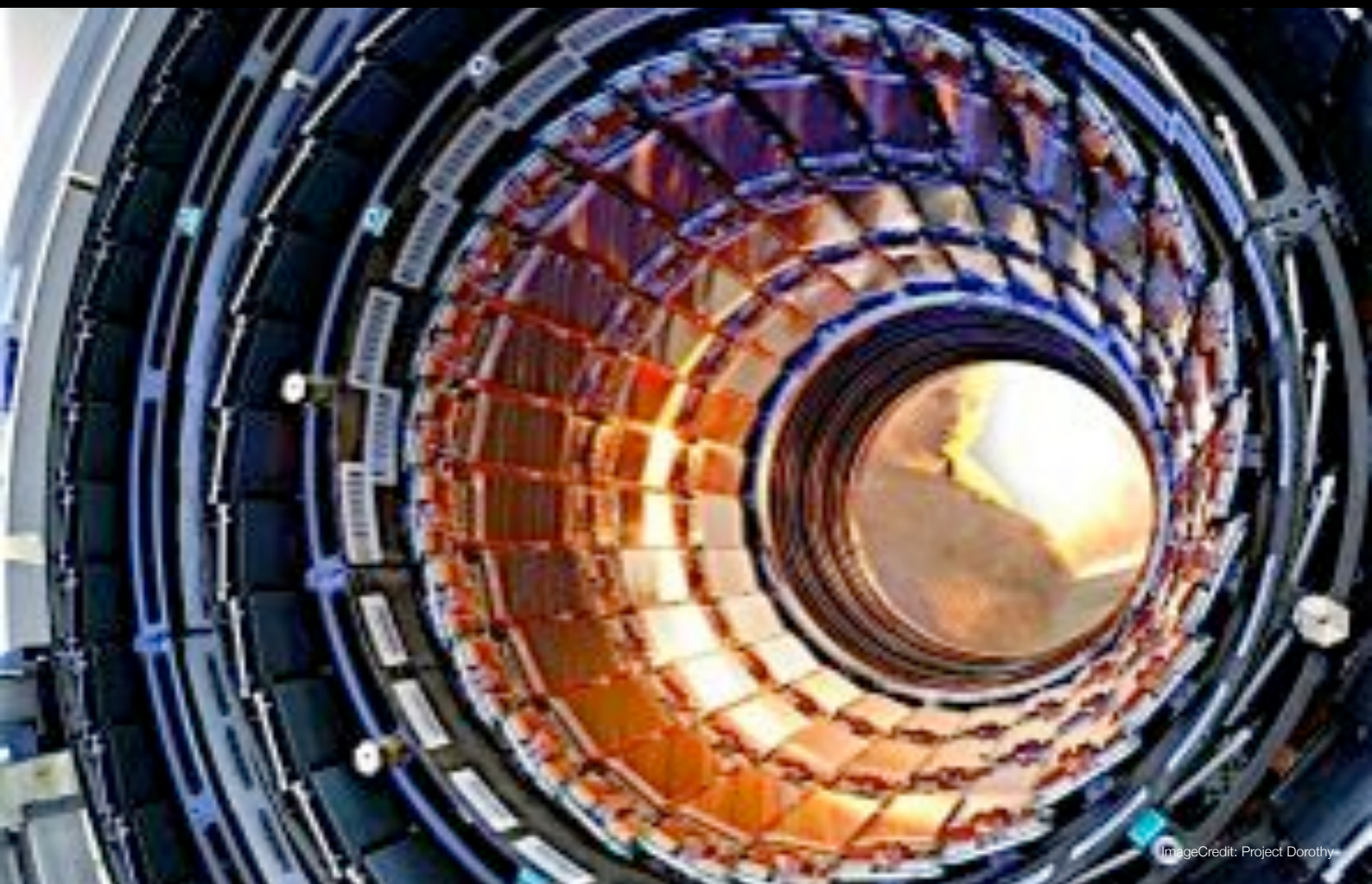
I did not do much star gazing because of light pollution here in the park. Sometimes, when I wake up around 5am in the morning, I see Venus and Jupiter and they still look beautiful. At night I observed Spica, Mars, Saturn and the Sickle Moon with my binoculars. I looked for astronomical articles on the internet. In the German magazine: "Spiegel Online Nachrichten", they wrote that the youngest pulsar is just 55 years old, when x-ray telescope Chandra observed it. Not talking like in Astronomy about millions or billions. This pulsar is in galaxy M83, and is 15 million light years from Earth, so we see a young pulsar which is not so young now.

Giant ice avalanches go over Saturn Moon Tapetus - Astronomers discovered 80 km long avalanches on the Saturn Moon Tapetus. They want to study them and compare them with mud slides on Earth

So I am reading many other astronomical articles include ABC Sciences from Prime Focus.

But I enjoy the nice sunshine too and traveling around in this nice area with the beaches, mountains and Islands which are volcanic and developed millions of years ago.

Ursula Braatz



A Visit to the Large Hadron Collider - Part 2

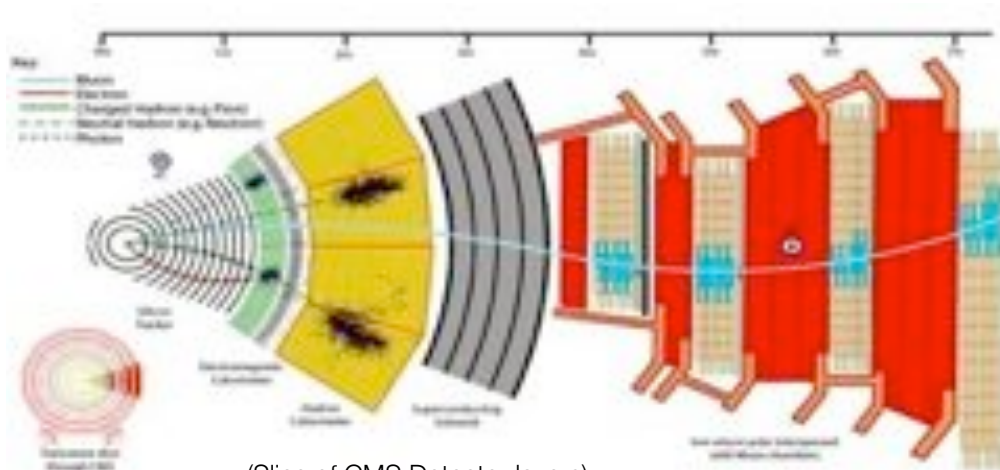
AN ARTICLE & PHOTOGRAPHS BY MAS MEMBER
ROBERT BEE

In Part 1 I described how, as a member of Fred Watson's Stargazer II tour in June 2010, I had the incredible experience of visiting and touring the Large Hadron Collider. I described the complex infrastructure that provided and managed the near light speed beams of protons (and also lead ions) that were designed to be brought to collision at designated points along their 27 km long circuit 100m metres beneath the surface under Geneva, Switzerland and across the French border. The infrastructure included the huge number of superconducting magnets, the RF accelerating cavities operating at 400MHz, super-vacuum technology, extreme cryogenics to achieve super-fluid helium at 1.9°K and the amazing beam-dump system. All to maintain two continuous counter-rotating 'beams' of 2808 discrete packets of protons, each packet containing around 100 billion (10^{11}) protons. The packets trail each other by about 7.5 metres (or 25 microseconds). At near light speed, each packet makes 11,245 circuits each second. In this part 2, I attempt to explain what it is all for, describing the four massive independent 'experiments' contained along the path of the beams.

The Experiment Detectors:

What is all this complex infrastructure for? Ultimately, all of it is for the sole purpose of arranging near light speed high energy packets of protons (or lead ions) to collide on cue in a controlled volume where super-detectors can 'detect' and record the myriad of particles that result so that knowledge of our universe can advance. This is done at the four detectors ATLAS, ALICE, CMS and LHCb.

These detectors, each built in the path of and all around the crossing beams, are by any measure, gigantic. Space here prevents a proper description of the nature of each but they can simply be described as containing multiple layers, each layer designed to perform a specific task and together they allow identification and precise measurement of the energies of all the particles produced in the proton-proton collisions. These layers are arranged like a cylindrical onion around the collision point, with further layers at each end of the cylinder to ensure all particles are captured. The diagram below shows the complexity of



(Slice of CMS Detector layers)

layers in the CMS Detector. The other detectors, though different in layout and using different styles of detecting equipment, follow similar principles. A common feature to all detectors is a huge internal magnetic field, provided by superconducting magnets of varying shape and type, to cause charged particles to follow a curved path. Detection of these paths allows identification of the individual particles. But that's just the beginning.

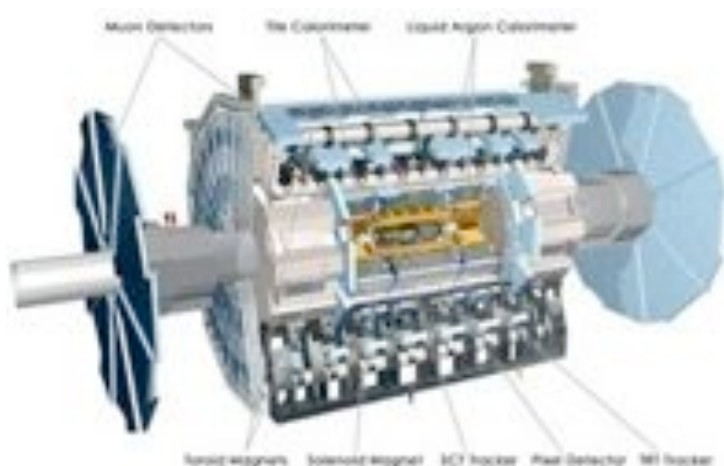
Here is a brief description of each detector:

ATLAS: A Toroidal LHC ApparatuS

Yes, one of the more excruciating acronyms. It is a scientific project in its own right, with around 2,500 scientists assigned to its work from 169 institutes and universities from around the world. The eight toroids in its name are shown in the following picture taken during its assembly 100 metres below ground level. Note the man in lower centre for scale.



As you can see from the diagram below, ATLAS is of immense proportions, worthy of its name. Note the two human figures for scale.



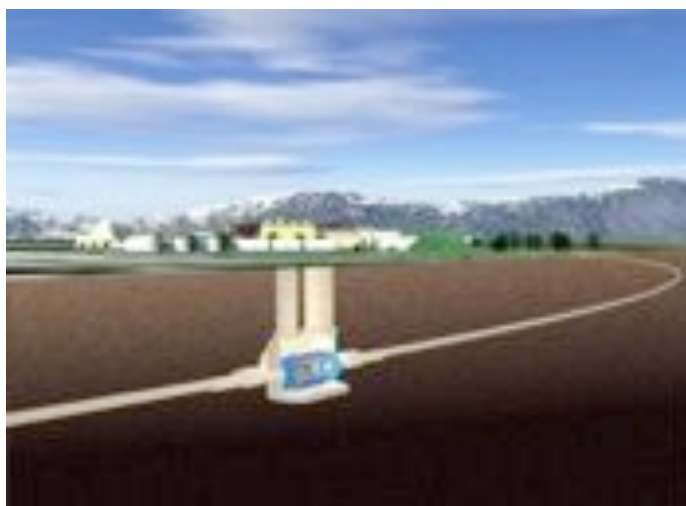
On the *Stargazer II* tour, we were fortunate to be able to observe the ATLAS control room, located comfortably at ground level. At the time, sadly, there was no beam running. Here you can see the physicists at their terminals and also the Stargazer group being 'lectured' by our guide Klaus.



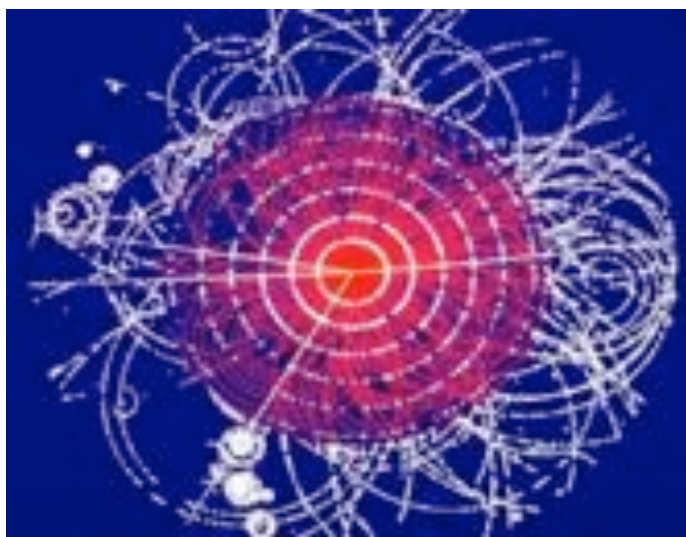
ATLAS Control Room

ATLAS was developed as a general-purpose detector to fully cover the rich physics potential of the LHC. This includes the search for the Higgs boson, dark matter, supersymmetric particles and extra dimensions.

The following diagrams shows how the ATLAS detector is located along the beam tunnel 100m beneath ground level and the particle activity inside ATLAS:



ATLAS Detector and Beam Tunnel



What goes on inside ATLAS

Here are a few of the key features of ATLAS:

- It is 45 metres long and 25 metres high;
- It weighs 7,000 tonnes;
- With eight 25-metre-long superconducting coils and closed at each end by two end-cap toroids magnets looking like giant cog wheels, it is the largest toroid magnet system ever built;
- It can store 1,600 Megajoules of magnetic energy, enough to lift the Eiffel Tower 16 metres off the ground;



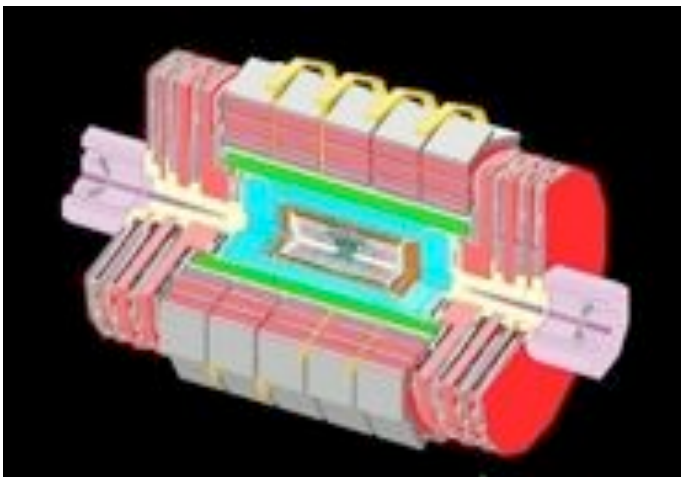
Stargazer group and Klaus

There are over 100 million sensors to detect the collisions particles, able to locate a track to within 0.02 mm.

It was ATLAS, with another LHC detector independently, that identified the potential Higgs boson announced on 12th July this year. Possibly one tick on the board.

CMS – The Compact Muon Solenoid:

This is another of the general-purpose experiments built to explore the physics at the TeV scale. It also involves over 2,500 scientists and engineers from over 180 institutes and 38 countries. A huge project! As its name suggests, the CMS was essentially designed for the accurate detection of muons, particles that are like heavy electrons, using its unique solenoid magnet. And it may be ‘compact’ but it is still the heaviest of the four LHC detectors, weighing in at 12,500 tonnes.



Cutaway of the CMS detector

CMS has the world's largest solenoid magnet, 13 metres long and 6 metres in diameter. Overall, the CMS detector is 21 metres long and 15 metres in diameter, less than half the size of ATLAS.

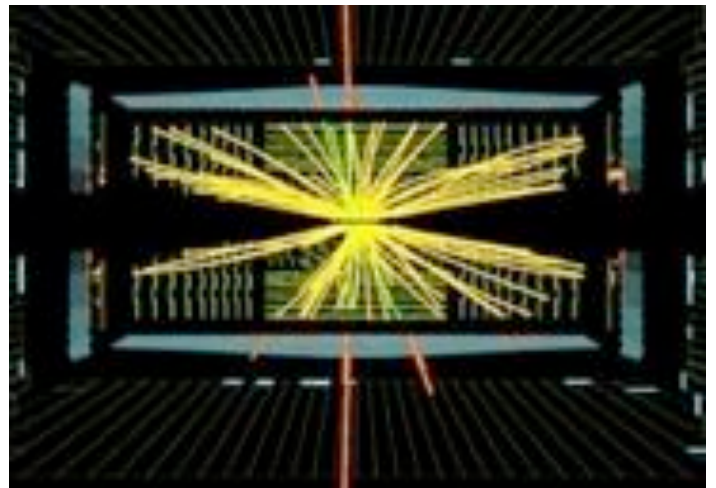
Its research targets, using its ability to detect muons, include the Higgs Boson – a ‘discovery’ it recently shared with the ATLAS detector – as well as dark matter, anti-matter and other exotic cosmological conundrums.

While hidden well beneath the ground level, the CMS's technical complexity is suggested by the brilliant colouring of its many thousands of special components. It simply exudes sophistication.



A section of CMS during installation

The image below is a recent result from CMS which led to the possible detection of the Higgs boson.



ALICE – A Large Ion Collider Experiment:

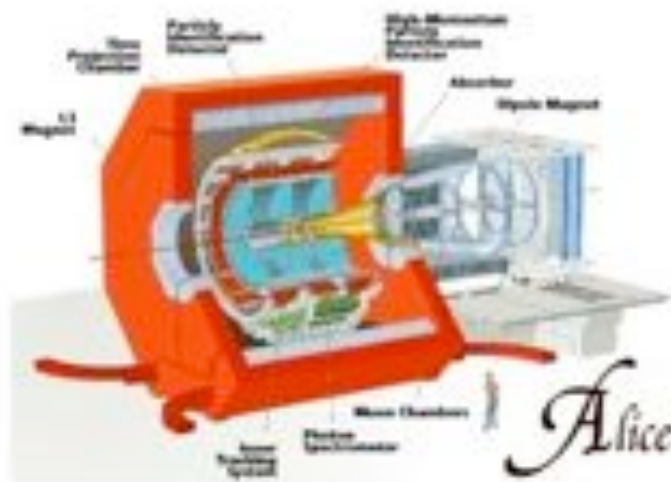
ALICE is designed specifically to look for the quarks and gluons present in the quark-gluon soup immediately after the Big Bang. Not literally, of course, but by reproducing the conditions of that early era by observing the collision of lead ions (hence the Large Ions in the title). The combined energy of two colliding 7TeV beams of lead ions is expected to produce temperatures up to 100,000 times those at the heart of our Sun, just as after the Big Bang. These temperatures should liberate quarks and gluons and ALICE is designed to capture and identify them.



Simulated collision of Lead Ions in ALICE

Imagine this. In ALICE's heart, after the lead ion collision, the created quark-gluon plasma survives less than 10^{-18} seconds. In cooling, the quarks give birth to some 20,000 new particles – for each of the 8,000 collisions per second. Each of the eighteen sub-detectors is designed to determine one property or the identity of one or more sorts of particles. Gathering this information helps physicists accumulate evidence about the creation of the plasma.

Referred to as 'one of the small detectors', ALICE stands 16 metres tall, 16 metres wide and 26 metres long. It weighs in at about 10,000 tonnes.



A cutaway of the ALICE Detector

ALICE's internal detection systems are radically different to those of ATLAS and CMS, as befits its different purpose. Too complex to describe here, it contains such detectors as a Silicon Pixel Detector (SPD), a very novel technology; a Silicon Drift Detector (SDD); a Time Projection Chamber (TPC) to allow 3-dimensional tracking; and a Time of Flight System (TOF)

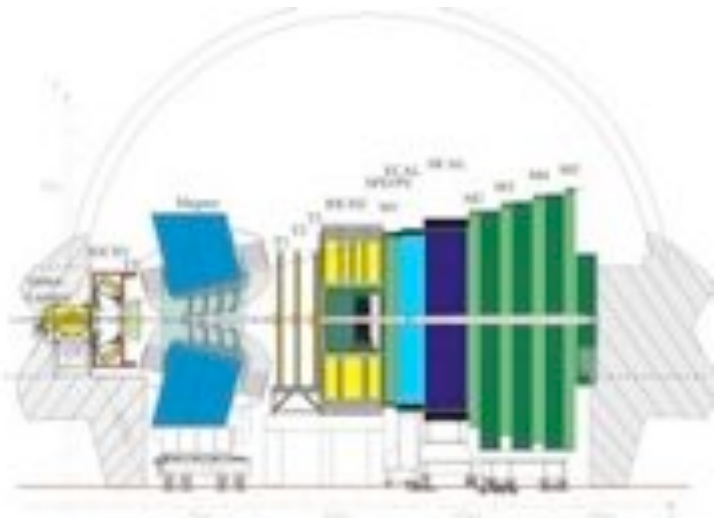
which is designed to distinguish between pions, kaons and protons with a time resolution of a staggering 50 picoseconds (50×10^{-12} s).

Straight out of a technological wonderland, ALICE sounds appropriately named.

LHCb:

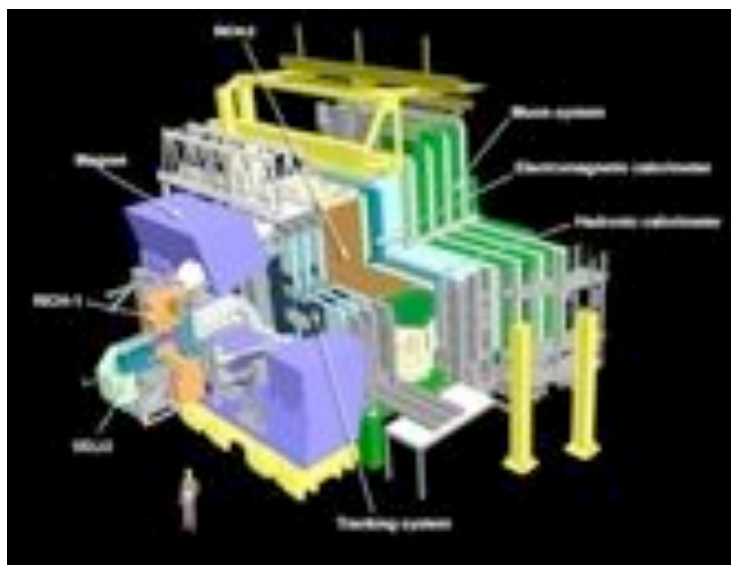
The LHCb Detector's prime aim is to answer the question: why was there more matter than anti-matter created after the Big Bang? Thankfully for us there was or we wouldn't be here. But the fact that there was makes physicists suspect that there may be subtle differences between matter and anti-matter. The LHCb experiment hopes to shed light on this question, looking at any differences in their decay rate, for example. The LHCb will study the decay rates of particles with the beauty anti-quark. Since beauty quarks and anti-quarks are heavy and didn't survive in today's universe, by reproducing the high energy, high temperature conditions of the Big bang it is anticipated they will observe these 'beautiful' particles and study their differences. That is where the 'b' comes from in its name: for the 'beauty' quark.

The LHCb collaboration involves 690 scientists from 48 institutions and 15 countries.



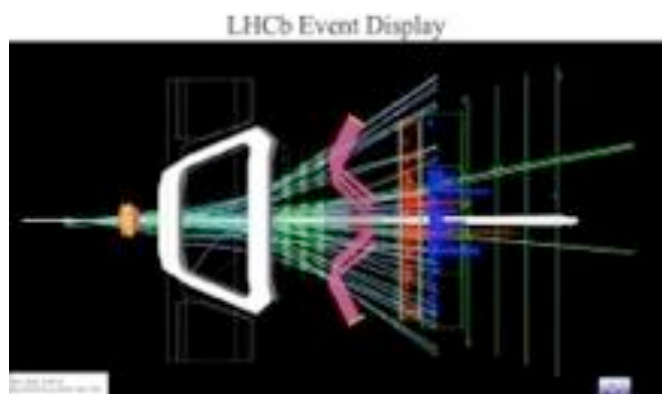
The layout of the LHCb detector is radically different from that of ATLAS and CMS. While they were of quasi-cylindrical shapes, optimised for particle detection perpendicular to the beam axis, the geometry of the LHCb resembles that of a reclining pyramid, with its apex located at the collision point. The LHCb's 4,500 tonne detector has been designed to efficiently detect B

mesons produced by b and anti-b quarks and to study the products of their decays. Instead of having the 'onion skin' structure of the other LHC particle detectors, the LHCb experiment stretches out 20 metres along the beam pipe, with its detectors spatially organised to efficiently measure the particles of interest.



Layout of the LHCb Detector

Shown below is an event recorded on the LHCb, along with a CERN cartoon which is typical of the humour displayed by its otherwise brain-heavy scientists.



Data Analysis:

When operating, the LHC produces an enormous amount of data. If it was all recorded, it would equal a rate of data of 1 petabyte per second. 1 petabyte (PB) = 10^{15} bytes \approx 200,000 DVDs full of data. Overwhelming!

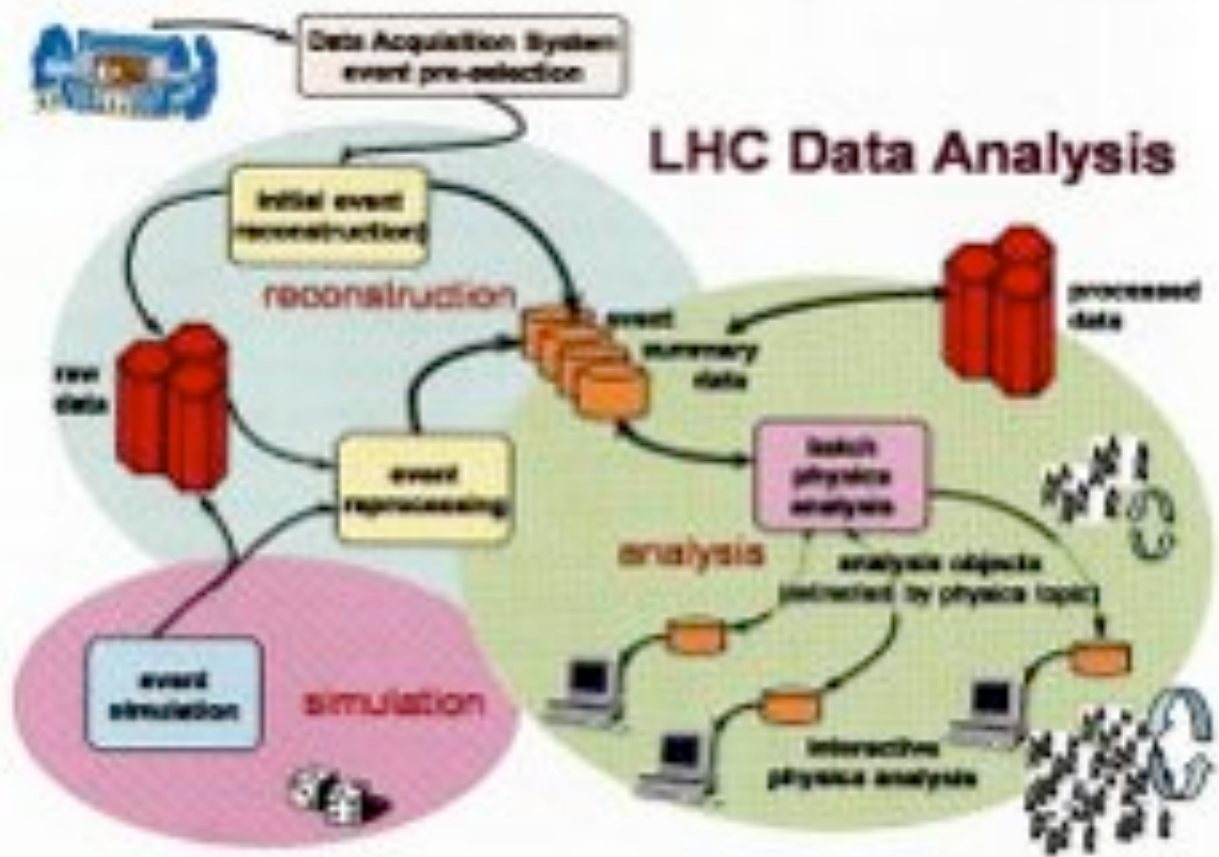
Thankfully, by using special electronics embedded in the detectors themselves and dedicated on-line computers, this is selectively reduced by six orders of magnitude to a much more 'manageable' rate of 1 gigabyte per second. This reduced data volume is recorded in magnetic storage for later analysis.

But even with this huge filtering and reduction process, there is still a formidable amount of data, approximately 30 PB per year. To put that into perspective: A standard DVC disc is 1mm thick. 30PB equates to a stack of DVDs 6 kilometres high. That data has to be managed and distributed to the many thousands of scientists around the world who are analysing the physics from the LHC.

As you may imagine, this is a task of gargantuan proportions. Understandably, automatic computer-based algorithms are an essential part of managing such enormous amounts of data which are piling up on the recording system every 25 nanoseconds as each packet of protons collide and produce their shower of particles. These very sophisticated algorithms, purpose designed by the scientists in each detector experiment, are applied successively to the raw data generated and collected for each experiment. This allows data in the form of observable events and physical quantities (such as charge, speed, momentum, energy etc) that can be compared to the theoretical predictions made by computer simulations. Effectively, the algorithms, applied at super-high speeds, sort out the 'chaff from the grain' before storage of the 'interesting' data.

This is all highly complex and a detailed reading of technical descriptions of the data systems, hardware and software involved tends to boggle the mind of laymen such as myself. A simplified 'high level' view of the data flow is shown in the diagram

To give an, albeit inadequate, glimpse of the logistics involved and the increased complexity of the LHC computing system from previous high energy accelerators and collider projects, consider these factors:



- For all four detectors – CMS, ATLAS, ALICE and LHCb – there are over 6000 scientists and engineers involved, an unprecedented number. A significant fraction of these are involved just in algorithm and program development.
- The computer environment to manage all this data analysis is very widely distributed, literally worldwide. There are approximately 100,000 processors installed in 140 computer centres in 35 countries, all integrated into the LHC computing grid, called 'The Grid'.

A key to this grid infrastructure is that the design and construction for it started over ten years ago and its job will continue for many more years. Yet, computer technology moves on at a prodigious rate and all the components of this complex system had to be designed to allow for and accommodate new computing technologies, even technologies not conceived of at the start. Flexibility for seamless transition is the key.

Conclusion:

Our tour of the LHC sadly came to an end after a visit to the CERN cafeteria where we shared lunch with what seemed like all 3,000 of the scientists and engineers working at the LHC. It was as chaotic as the

inside of one of their detectors. On driving away we compared personal impressions. One thing was predominant in our minds: The Large Hadron Collider's claim to be the most complex single 'machine' ever built was no exaggeration.

* * *

References:

- "The Large Hadron Collider: A Marvel of Technology" edited by Lyndon Evans.
- "Destination Universe" Published by CERN

NASA Watch: Curiosity Goes Forth

August 17th 2012

PASADENA, Calif. -- The scientists and engineers of NASA's Curiosity rover mission have selected the first driving destination for their one-ton, six-wheeled mobile Mars laboratory. The target area, named Glenelg, is a natural intersection of three kinds of terrain. The choice was described by Curiosity Project Scientist John Grotzinger of the California Institute of Technology during a media teleconference on Aug. 17.

"With such a great landing spot in Gale Crater, we literally had every degree of the compass to choose from for our first drive," Grotzinger said. "We had a bunch of strong contenders. It is the kind of dilemma planetary scientists dream of, but you can only go one place for the first drilling for a rock sample on Mars. That first drilling will be a huge moment in the history of Mars exploration."

The trek to Glenelg will send the rover 1,300 feet (400 meters) east-southeast of its landing site. One of the three types of terrain intersecting at Glenelg is layered bedrock, which is attractive as the first drilling target.

"We're about ready to load our new destination into our GPS and head out onto the open road," Grotzinger said. "Our challenge is there is no GPS on Mars, so we have a roomful of rover-driver engineers providing our turn-by-turn navigation for us."

Prior to the rover's trip to Glenelg, the team in charge of Curiosity's Chemistry and Camera instrument, or ChemCam, is planning to give their mast-mounted, rock-zapping laser and telescope combination a thorough checkout. On Saturday night, Aug. 18, ChemCam is expected to "zap" its first rock in the name of planetary science. It will be the first time such a powerful laser has been used on the surface of another world.

"Rock N165 looks like your typical Mars rock, about three inches wide. It's about 10 feet away," said Roger Wiens, principal investigator of the ChemCam instrument from the Los Alamos National Laboratory in New Mexico. "We are going to hit it with 14 millijoules of energy 30 times in 10 seconds. It is not only going to be an excellent test of our system, it should be pretty cool too."

Mission engineers are devoting more time to planning the first roll of Curiosity. In the coming days, the rover will exercise each of its four steerable (front and back) wheels, turning each of them side-to-side before ending up with each wheel pointing straight ahead. On a later day, the rover will drive forward about one rover-length (10 feet, or 3 meters), turn 90 degrees, and then kick into reverse for about 7 feet (2 meters).



"There will be a lot of important firsts that will be taking place for Curiosity over the next few weeks, but the first motion of its wheels, the first time our roving laboratory on Mars does some actual roving, that will be something special," said Michael Watkins, mission manager for Curiosity from the Jet Propulsion Laboratory in Pasadena, Calif.

The Mars Science Laboratory spacecraft delivered Curiosity to its target area on Mars at 10:31:45 p.m. PDT on Aug. 5 (1:31:45 a.m. EDT on Aug. 6), which included the 13.8 minutes needed for confirmation of the touchdown to be radioed to Earth at the speed of light.

The audio and visuals of the teleconference are archived and available for viewing at:

<http://www.ustream.tv/nasaajpl>

The mission is managed by JPL for NASA's Science Mission Directorate in Washington. The rover was designed, developed and assembled at JPL, a division of Caltech. ChemCam was provided by Los Alamos National Laboratory. France provided ChemCam's laser and telescope.

For more information about NASA's Curiosity mission, visit: <http://mars.jpl.nasa.gov/msl>.

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Jet Propulsion Laboratory, Pasadena, Calif.
guy.webster@jpl.nasa.gov / agle@jpl.nasa.gov

the forest - please come along!

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

Where is it you might ask? It takes approximately 50 minutes to get there from Campbelltown, along the Hume Highway until you see the Belanglo Road sign, just past the Sutton Forest turn off. You turn right across the highway and follow the dirt road (Belanglo Road, formerly Bunnigalore Road) for approx 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 bed linen or sleeping bags. There is hot and cold running water, showers and toilets. There is a complete kitchen with stove, 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 freezer/ski boots are 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!

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



ESO Watch: Orion watching over ALMA

August 2012



Standing watch over the antennas of the Atacama Large Millimeter/submillimeter Array (ALMA), Orion, the Hunter, shines high in the Chilean night sky. With its distinctive hourglass shape and the three bright stars of Orion's Belt in the centre, the constellation is easily recognisable. Taken from the southern hemisphere, this image shows Orion's sword above the Belt. The sword is home to one of the most stunning features of the sky — the Orion Nebula — which appears as the middle "star" in the sword, its fuzzy nebulosity visible to the naked eye under good conditions.

The three ALMA antennas visible in the image represent only a small part of the complete ALMA array, which has a total of 66 antennas. ALMA combines the signals from its antennas, separated over distances of up to 16 kilometres, to form a single giant telescope, using a technique called interferometry. While construction is not due to be completed until 2013, early scientific observations began with a partial set of antennas late in 2011.

At 5000 metres altitude on the Chajnantor Plateau in the foothills of the Chilean Andes, in one of the most arid regions in the world, ALMA is guaranteed outstanding observing conditions. A high, dry site such as Chajnantor is needed because water vapour and oxygen in the Earth's atmosphere strongly absorb the millimetre and submillimetre wavelengths of light at which ALMA is designed to observe.

In this photograph, the antennas were being tested at ALMA's Operations Support Facility, located at the slightly lower altitude of 2900 metres. Once tested and fully equipped, they were transported up to the Chajnantor plateau to begin their work.

This image was taken by Adrian Russell, who submitted the photograph to the Your ESO Pictures Flickr group. The Flickr group is regularly reviewed and the best photos are selected to be featured in our popular Picture of the Week series, or in our gallery. In 2012, as part of ESO's 50th anniversary year, we are also welcoming your historical ESO-related images.

ALMA, an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.



M8 - Lagoon Nebula - Tony Law



Top: M64 Black Eye Galaxy - Luke Williams

Below: Omega Centauri - Luke Williams



The Standard Model

Musings - hum - never thought of myself as a muse! However, I'm quite surprised Prime Focus isn't essentially a compendium of musings - considering the universe is such a catalyst for musings generally.

The word - muse - is these days perhaps more associated with day-dreaming or idle thoughts. The origin though, is very different, with its roots way back with those - oh so Ancient Greeks. There are nine Greek Muses; all with excellent family credentials in the gods' department - each associated with a different set of inspirational or philosophical disciplines.

Astronomy - falling well within these parameters - unsurprisingly, has its own dedicated muse, who goes by the name of Urania. Her cloak, naturally, is emblazoned with stars and symbols and her attention is centred at all times on the glorious heavens above.

*Urania, o'er her star-bespangled lyre,
With touch of majesty diffused her soul;
A thousand tones, that in the breast inspire,
Exalted feelings, o'er the wires'gan roll—
How at the call of Jove the mist unfurled,
And o'er the swelling vault—the glowing sky,
The new-born stars hung out their lamps on high,
And rolled their mighty orbs to music's sweetest sound.*

—From An Ode To Music by James G. Percival

Anyway, that'll be quite enough of that - thank you - it's time I revealed my musings of late. I think the hopeful discovery of the Higgs' Boson prompted my current line in musings. With talk of various models of the universe coming to the fore, one cannot help but ponder, in an uninformed and somewhat crude manner, on the secrets that yet lay undiscovered.

I have just a sneaking suspicion that whilst the universe in its entirety is indeed an extremely complex affair, once its origins are revealed, the 'processes' which brought it about will essentially be simple. Funny how anyone can make that type of statement with hindsight (or in ignorance)!

Having exposed my unsubstantiated musings I am obliged to some degree to explain myself with - if possible - a terrestrial equivalence. After a further extended period of musing - hopefully the following might make a skerrick of sense.

Think of an electricity generating station - coal - hydro - nuclear - gas - geothermal or whatever; the initial process of generating electricity is much the same whatever the source or mode of generation. The result is a reasonably clean and simple process that leads to the formation of pure energy in a distributable form; then the electrical energy bursts forth and leaves the plant at the speed of light!

It is now the process of the conservation of energy begins in earnest, and is played out in a million different ways in our daily lives. The pure energy aids the production of all the wonders of our modern world. Not only that, at times it even causes the occasional tragedy. Take the death of an unwary or complacent human being - an electrician or enthusiastic amateur - who gets themselves killed whilst working with this invisible Wunderkraft.

All this complexity and drama, however, is developing far from the generating plant. Once combined with other technologies the original clean and pure electrical energy may even produce yet more undesirable results, such as noxious waste products, or other less obvious pollutants such as light or noise pollution (think Rock concert).

Put quite simply: I envisage the universe to be much the same - that which the enthusiastic, dedicated astronomer will spend hours - often enduring bitter cold nights or balmy mosquito infested summer evenings - to soak up through the eyepiece of equipment (that costs an arm and a leg) may simply be the debris released or created far from the original simple generating source of the pure energy. The natural processes of mixing gases - superheating - cooling - swirling - the generation of vast fields of electro-magnetic forces - and the intermingling of massive secondary forces, will obviously bring about many seemingly unexplainable phenomena. Such phenomena may though in fact have very little to do with the original relatively simple source of production. Oh well - it was only a thought...



Image Credit: Humayun Qureshi



humayun qureshi - august workshop

DSLR imaging and general astro photography processing.

Humayun is an aspiring professional wedding & landscape photographer from Canberra, who has also very successfully applied his high-end DSLR cameras to astrophotography. Although having recently moved on to CCD imaging, Humayun will present a talk on the vagaries & challenges of delivering aesthetically pleasing DSLR images by detailing his own approach to pre & post-processing.



Image Credit: Chris Malikoff

heavens above!

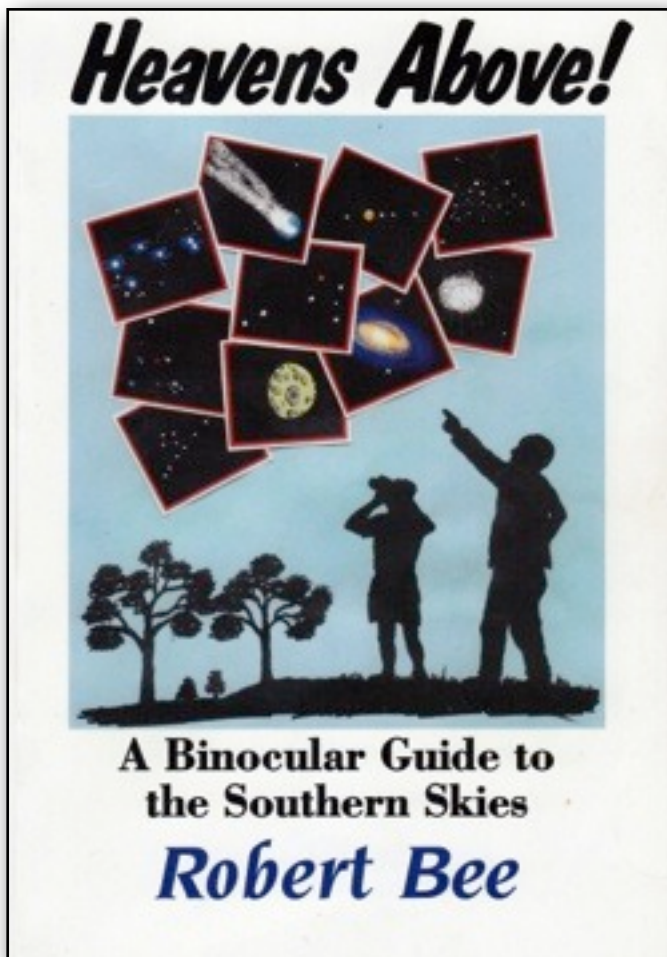
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It is a very common misconception by people on the fringe of amateur astronomy that you absolutely need a telescope to "see anything interesting".

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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.

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- 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 woolies! It's cold 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

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