



**Wellington Astronomical Society June 2015 Volume 45 Issue 5**  
 WWW.WAS.ORG.NZ, ISSN 01147706 - PRINT, ISSN 2230-5912 ONLINE

*The next WAS meeting will be held on Wednesday 3rd June 2015 at 7:30 pm  
 at Carter Observatory, Upland Rd, Kelburn, Wellington*

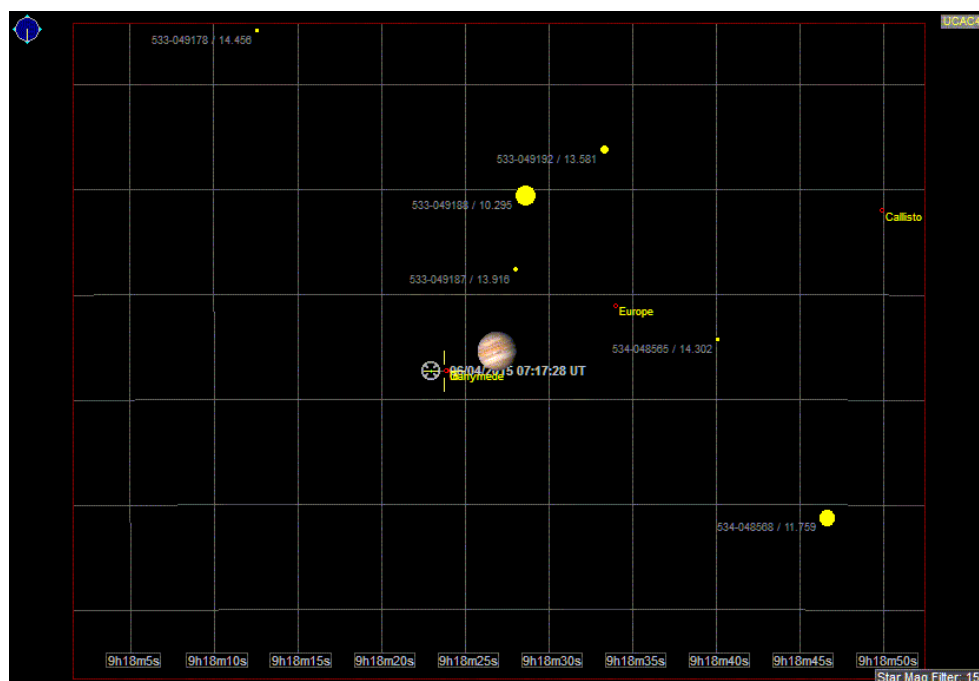
## Jupiter Moon Events:

Transits, Eclipses, Mutual Occultations, Eclipses, Extinction  
 Events

**John Talbot (WAS)**

We will also see images of Tekapo from student Edward Wilcock and  
 Aurora and Night Sky images from Frank Andrews.

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## PRESIDENTS REPORT JUNE 2015 GORDON HUDSON

This month of May has been a busy time for Astronomy mainly with the RASNZ conference in Tekapo and the 50 year Anniversary of Mt John also in Tekapo and the Minor Planet Symposium also at Tekapo. Reports on these events are elsewhere in the newsletter.

The Director of the AAVSO (American Association of Variable Star Observers) Stella Kafka her talk was "Variable stars and their stories". The talk was held at Carter on Monday 4th May and was well attended as this was a normal WAS meeting evening.

Stella has a BSc in Physics and a PhD in Astrophysics. She has held post-doctorate fellowships and appointments at the Cerro Tololo Inter-American Observatory in Chile and at NASA's Spitzer Science Center at Caltech University. She also spoke at the RASNZ conference in Tekapo about the 'Elusive Supernova la progenitors'.

The membership cards were distributed to those attending members at the May meeting and these should be worn at all WAS meetings. Those of you who have not picked up your card, please do so at the next meeting.

The Beatrice Hill Tinsley Lecturer this year was Professor Gerry Gilmore who spoke to us at the Royal society Rooms at 6pm on Friday 15th May. This was attended by about 70 people about half of what we expected. However the storm that raged the day before leaving a lot of water damage and no public transport had much to do with the smaller numbers. This was a most interesting talk.

The talk was called GAIA which is about a satellite which is mapping the stars in the whole of our galaxy. This is collaboration with only European nations and is already producing spectacular results. Several council members of WAS took Gerry out to dinner after the talk at an Italian restaurant just along the road from the Royal Society.

Later in the year in October we will have Professor Chris Lintott visiting us and this should be quite a memorable occasion however details for this lecture are still being sorted so watch this space.

The WAS dome which has been stored at my place for the last 2 years is still there.

Work has begun on ground preparation for the piles and pier.

The Syd Cretney Bequest letter has been finally sent to the Lawyers and we are still waiting a reply. However the committee may need to meet again to discuss the bequest.

We are starting to acquire a rather a lot of items as we are no longer storing equipment, books, newsletters and other material at Carter as the workshop is being emptied for other purposes this leaves us with a problem where to store stuff until we have a home of our own. Having acquired the Gun Bunker the WAS storage material is now in the bunker along with all RASNZ Archive. This is only for about 12 months

The volunteering at Carter is going well but it is mainly through the efforts of a couple of our members. We need more volunteers.

We assist on Tuesdays and Saturday evenings so put your hand up at the next meeting.

Finally the WAS observing evening once a month at Tawa College is struggling with lack of observers. Where are you all? The next observing evening at Tawa College is on Saturday 10th June starting at 6.30pm a backup day is the following Saturday 17th June.

## WAS COUNCIL MEMBERS AND CONTACTS

### Council Members

The following members were elected to Council at the Nov 2014 AGM

**President:** Gordon Hudson

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**Treasurer:** Lesley Hughes

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John Homes + Webmaster

Roger Butland

Frank Andrews

Murray Forbes

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## RASNZ 2015: CHRIS MONIGATTI

The 2015 conference of the Royal Astronomical Society of New Zealand was held in Tekapo village, in the centre of the MacKenzie Country Dark Sky Reserve, and close to the Mt John Observatory complex. With around 140 attendees this was one of the larger RASNZ Conferences.

Proceedings began on Friday 8 May, with tours to the observatory, and then the conference opening with Claire Barlow, Mayor Mackenzie District Council followed by a talk by Dr Karen Pollard on Astroseismology.

The Saturday morning session, which began two full days of interesting presentations, was dominated by 'WAS people'. Dr Denis Sullivan discussed Pulsating White Dwarfs (and will hopefully follow up with a WAS talk later this year), John Talbot highlighted the need for more Occultation observers (or maybe that we investigate the multi-station method presented by Dr David Dunham), and Gordon Hudson linked the historic observatories in Wellington to the up-coming RASNZ Centenary in 2020.

Dr Phillip MacQueen a Kiwi who is now at the McDonald Observatory in Texas made us envious of the quality of public outreach that can be offered when both public and private money is invested in scientific facilities. I would recommend a visit to this observatory to anyone holidaying in Texas.



**Some of the WAS contingent – Gordon, John, Edward, Antony**

Professor Gerry Gilmore gave a major presentation on the Gaia project and the mind-boggling amount of incredibly accurate data that it will gather on the distances and distribution of over 1 billion stars in the Milky Way Galaxy (he also gave out many Gaia badges, stickers and fridge magnets) – Gerry gave another presentation in Wellington on Friday 15 May). Fraser Gunn amazed all present with several of his time-lapse videos filmed from Mt John (you can find these on YouTube).

Fittingly, as 2015 is the International Year of Light, Steve Butler presented some ideas for involving students and Astronomical societies in measuring sky brightness and planning to reduce light pollution.

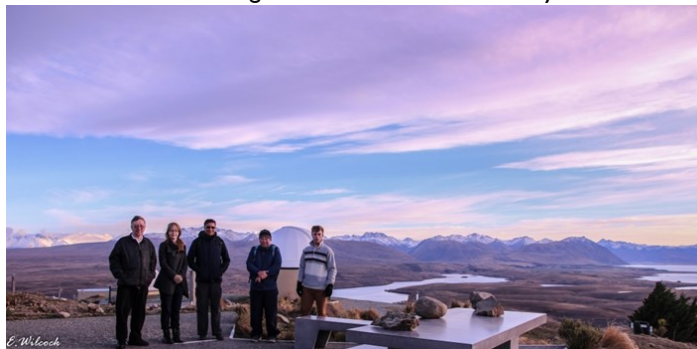
For the Saturday evening conference we squeezed into the Godley Hotel dining room – numbers had exceeded early expectations. At our table there were secondary school students from St Bernard's College, Otago Boys High School, and Kavanagh College, all present at the conference as part of a RASNZ initiative to encourage students into Astronomy. RASNZ had invited applications from both University and secondary students from throughout New Zealand, and awarded 16 free conference registrations to those selected (10 to secondary students and 6 to University students). This was a fantastic initiative and hopefully will be continued (it follows the generous sponsorship, by a WAS member, of students to the conference dinner in Wellington in 2009).

WAS's own Frank Andrews (though the local CAS people were part-claiming him) gave the after-dinner talk on some of the history of the Canterbury Astronomical Society.

On the Sunday morning, a group of WAS people walked up to the observatory for some sight-seeing before the day's talks – it is a truly spectacular site, the walk is much easier than Mt Kaukau, on an excellent track, and has the bonus of a café at the top (you can drive also):

**WAS at Mt John Observatory: Don, Morag, Antony, Chris, Edward: Image: Edward Wilcock**

Dr Stella Kafka, who gave us the WAS talk for May, enthused us



with more intriguing variable stars, and Dr Ed Guinan discussed the possibility of life developing on planets around Red Dwarf stars – sadly given the number of such stars, Ed was not convinced that conditions there favour life, and he left us with his view that Orange Dwarfs would be better bets.

Gary Sparks from the Napier Astronomical Society encouraged us all to visit Napier for the 2016 conference, which will be held over the weekend of May 13 – 15. I would thoroughly recommend that WAS members consider this – you do not need to be a RASNZ member to register (though it does cost a little less if you are). At Tekapo, there were 18 WAS 'members' and several other Wellingtonians, a fantastic effort considering the travel distance – at Napier we should aim for even more!! The 2016 conference will have an 'Astrobiology' theme, and Gary will ensure a lively conference dinner with plans for fancy-dress (Electro-magnetic spectrum theme) and dancing.





There were a number of other high quality presentations – the handful mentioned above were those with a WAS connection – details of the full program are available at - <http://rasnz.org.nz/groups-news-events/conf-confprog>

Tekapo was a stunning location for the conference, though the higher than expected number of attendees stretched the capacity of the conference hall and dinner venue. Within the next five

years, the WAS council hopes to host another conference in Wellington (we have applied to host the 2020 conference). If any members have any suggestions for venues or accommodation suggestions, please let council members know (or you may even like to volunteer to be on a conference sub-committee!!).

**Above:** Conference attendees image courtesy of Fraser Gunn

## TTSO9 A BRIEF OVERVIEW OF PROCEEDINGS BY JOHN TALBOT

TTSO9 was held on Monday and Tuesday 11 and 12 May 2015

We met in the mezzanine space at The Godley Hotel which had the advantage of being warmer than some of the other spaces.

Steve Kerr, the new Director of Occultation Section, Opened the meeting and welcomed the 27 or so attendees.

Dr David Dunham described his early years setting up IOTA and leading Lunar Graze expeditions

John Talbot present a short review of recent successful asteroidal occultations in AUS and NZ in the past year

Graeme McKay described observing a fast moving Near Earth Asteroid.

Dave Herald gave an introduction to the new URATI catalogue with improved accuracy for some zones of the sky. This is expected to improve prediction accuracy for the next few years and then to be superseded by a Gaia catalogue.

Hristo Pavlov gave a remote talk on how to contribute to the Tangra 3 open source project. The key requirement is some experience with C# programming language.

Dave Herald reviewed the science gained from asteroidal occultations: Profiles, 3D models, discoveries and data archiving.

David Dunham described the journey he and his wife Joan are undertaking during a year of astro-tourism down under and up north.

Steve Russell introduced the IOTA-VTI V3 with a number of refinements. Probably the leading Video Time Inserter in the

world.

Dave Herald explained the importance of the Kepler2 program and the value of Lunar and Asteroidal occultation light curves to assist the choice of targets.

Brian Loader reported on double star occultations.

Brian Loader and Gordon Hudson gave a personal appreciation and some recollections of the late Graham Blow.

John Talbot issued a plea for volunteers to start taking up some of the work under taken by older members who may have a short remaining “use by date” so that any critical function they perform for Occultation Section get at least duplicated and understood by new people. We want to avoid the problems that Graham’s death left us with. It has taken us the best part of 6 months to get fully on top of some of these.

He thanked John Homes and Graeme McKay for agreeing to start taking on some of the reduction work.

Steve Russell discussed make your smart phone into a beeper box. This would be especially useful for those making visual observations.

Bill Hanna described some upcoming high interest occultations (e.g. Pluto on 29 June and Venus on 08 October).

Steve Kerr outlined some Occultation highlights for 2015 and 2016

Brian Loader explained the problems of image saturation and its effect on the detection of faint components of close double stars .

# Mt John 50th Anniversary Symposium Lake Tekapo, 6-8 May 2015

## Wednesday 6 May

Opening reception, Godley Hotel, Tekapo

Welcoming speeches by: Associate Professor Karen Pollard, Director of Mt John University Observatory; Professor Mike Reid, Head of the Department of Physics and Astronomy; Professor Wendy Lawson, Pro-Vice Chancellor for Science, University of Canterbury; M/C Professor John Hearnshaw, Emeritus Professor of Astronomy.

## Thursday 7 May Session 1

Alan Gilmore, Lake Tekapo, NZ: Reminiscences of site testing days on MJ.

Audrey Walsh, Wollongong, NSW: My father's work in establishing Mt John

Ed Guinan, Villanova University, Pennsylvania: My Year at Mt John Observatory.

1967-68: Astronomy and Other New Zealand Adventures.

Alan Thomas, NIWA, Lauder, Central Otago: My Time with the Astrograph.

## Session 2

George Wolf, Missouri State University, Springfield, MO: Observing at Mt. John. again and again.

Gerry Gilmore, University of Cambridge, UK: How Mt John made my career, and some thoughts for its future.

Michael Snowden, Christchurch and Cairns, QLD: Some Early Misadventures at Mt John

Rod Austin, New Plymouth, NZ: Hermitology: eight years on a Mountain.

William Tobin, Vannes, Brittany, France: The Mt John lease..

## Session 3

John Hearnshaw, University of Canterbury, Christchurch: Mt John University Observatory: the first 50 years.

David Buckley, South African Astronomical Observatory, Cape Town: From small to big: how MJUO prepared me and the continuing relevance of small telescopes.

Graeme Kershaw, University of Canterbury, Christchurch: My role in the development of Mount Johns instrumentation over the last 45 years..

Denis Sullivan, Victoria University, Wellington: 42 Years Observing at Mt John.

Timothy Banks, Singapore (formerly VUW, Wellington): Some recollections of a PhD student at Mt John.

## Session 4

Duncan Hall, Wellington, formerly SKA, Manchester: Dark matters: engineering adventures in developing instrumentation for astronomy.

Phillip MacQueen, McDonald Observatory, University of Texas, Austin, TX: Mt John's

first digital detector and related experiences as the spring board for my career.

William Tobin: Vannes, Brittany, France: The first CCD at Mt John.

Mike Bessell, Mt Stromlo Observatory, ANU, Canberra: The 2005 Bessell report on NZ's need for a national observatory.

Banquet at the Godley Hotel: Featured the much acclaimed oratory of Dr William Tobin, all the way from France.

## Friday 8 May Session 5

Phil Yock, University of Auckland, Auckland, NZ: The origin and possible outcomes of the Japan/NZ collaboration in astronomy. Yasushi Muraki, Nagoya University, Japan: The 1.8-m MOA telescope at Mt John.

Nick Rattenbury, University of Auckland, Auckland, NZ: Six Months on the Mountain.

Fumio Abe, Nagoya University, Japan: Results on extrasolar planets from the MOA project.

Graeme Murray: Earth & Sky Ltd, Lake Tekapo: Earth and Sky: Reaching for the stars.

## Session 6

Stella Kafka, Director AAVSO, Cambridge, MA: The AAVSO robotic telescope at Mt John.

Karen Pollard, University of Canterbury, Christchurch: Observing variable stars at Mt John.

John Hearnshaw, University of Canterbury, Christchurch: How stellar spectroscopy came to Mt John..

George Wallerstein, University of Washington, Seattle, WA: New Radial Velocities of Cepheids including the Paschen Lines and the Call Triplet (with M. Albright).

Alan Gilmore, Lake Tekapo, NZ: Chasing Near-Earth Objects at Mt John.

## Poster Papers

1. Phil Evans, Stan Walker, Alan Baldwin, Mark Blackford, Aline Homes, Carl Knight, Pauline Loader, David Moriarty, Tom Richards and Margaret Streamer: Research of Variable Stars South, RASNZ.

2. Phil Evans, Stan Walker, Alan Baldwin, Mark Blackford, Aline Homes, Carl Knight, Pauline Loader, David Moriarty, Tom Richards and Margaret Streamer: Research of Variable Stars South, RASNZ.

3. Karen Pollard, Graeme Kershaw, Sharlene Mullen & Dale Kershaw: Restoring the Townsend Telescope..

## Mt John Open Day 2.00 - 4.30pm on Friday 8th May.

This gave the participants of the Symposium a chance to see the telescopes on Mt John and to see how the instruments are being used.

The Optical Craftsman 24in telescope in a fork mount has been given to the AAVSO to use and has been fully automated so it can now be run from the USA. There is a high resolution CCD camera fitted onto the telescope.

The 24in Boller & Chivens is being used by the MOA group for Microlensing however it can still be used occasionally by Earth & Sky for visual observing.

The 1.8 meter telescope is used for Microlensing the discovery of Extra Solar Planets and it has discovered several of these Planets.

The 1 metre telescope is still used by Alan Gilmore & Pam Kilmartin for their Asteroid mapping program. Alan & Pam no longer live on Mt John they have retired to their new home in the Tekapo Village.

The Earth & Sky restaurant was doing a great trade in serving coffee & Muffins.



## AURORA FROM TEKAPO: GORDON HUDSON

On the last evening of our RASNZ conference week that is Wednesday 13th of May I received a text from Alan Gilmore who was up at the 1 meter telescope on Mt John. The text read just "Aurora". This was at about 7pm.

Frank Andrews who was staying with me in the Garden Tower were the only ones left as the others had left earlier that day.

Frank was keen to try out his camera on the night sky as we he hadn't had a chance earlier as the weather was not that good on previous nights and we were also involved in other events.

We decide to drive down towards Twizel this was just after 7pm. Frank new exactly where he wanted to stop. It was about 15km south of Tekapo. Just off the main road on an entrance to the aqueduct.

The sky was magnificent with the Milky way stretching from horizon to horizon from east to west. To the south there was this milky glow in the sky but was quite low to the horizon.

This was the aurora we had come to see. A quick photo showed it was definitely an aurora although not exactly a bright or a very high aurora.

We spent the next 10 minutes setting up our camera gear. I was using my Cannon 350D camera with settings of 30 sec exp at f3.5 using a standard 18 to 55mm zoom lens and a setting of 1600asa with the lens set to manual. The results are as can be seen in the

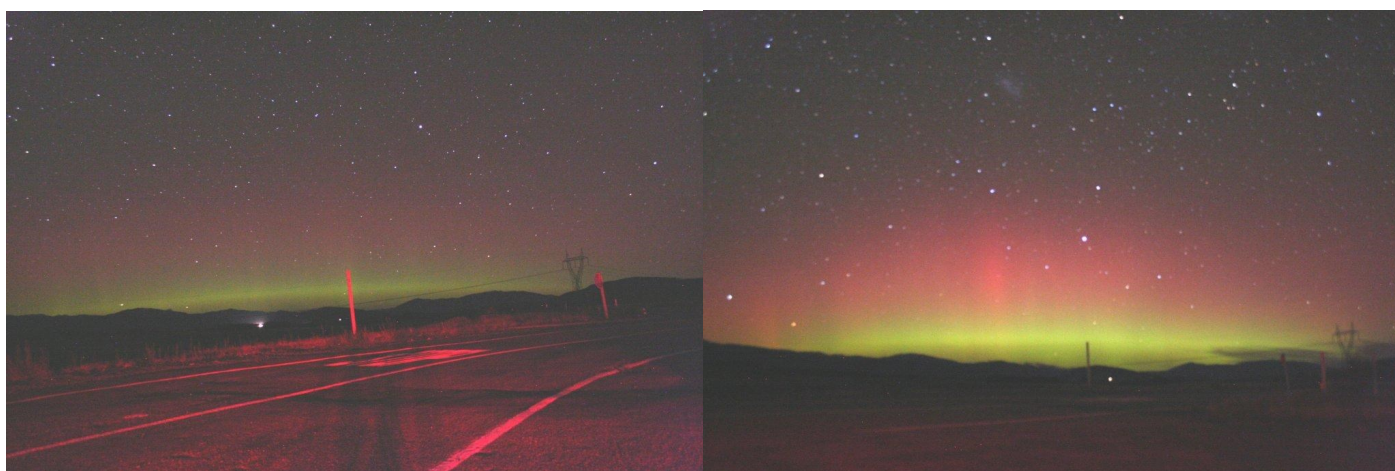
photos.

The time was about 8pm and Frank had finished setting up his Nikon D3S Camera on the tripod. This camera was far more advanced than my cannon and was using ASA setting of 10000 and exposures of hours if required. The size was 12.5 mega pixels the lens he was using was a 14 to 24mm wide angle at f2.8 and only 15 sec exposures Franks photos are quite magnificent when he had finished taking lots of photos of the aurora at about 10pm the aurora was starting to fade he then turned the camera on the night sky. There were no lights anywhere except for the occasional car or truck that went past. These images are spectacular and we will be showing them at the next WAS meeting.

When you are out taking photos the time fly's past we had decided when we left Tekapo we would be back about 9pm. However Frank was still taking photos at 11pm and we finally arrived back at Tekapo at about 11.30pm.

The next day we left for Christchurch. I travelled back with the Loaders and Frank left a bit later for Ashburton.

On our return to Christchurch we called into the Yaldhurst Car Museum as this is where the 18" Breshear telescope is currently being stored. This is NZ's largest refractor telescope and is destined for Earth & Sky and will be on the waterfront at Lake Tekapo under a 45ft dome.



**Above:** Aurora lights up the southern sky

**Right:** the mount for the 18" Breshear Refractor at the Car museum in Yaldhurst.

**Left::** the Tube assembly of the 18" Breshear Refractor at the Car museum in Yaldhurst.



## A TOUR THROUGH SCORPIUS: FROM THE RASNZ WEBSITE

This is a splendid constellation in a rich area of the Milky Way. It is one of the few constellations that bear a resemblance to the object after which it is named. In mythology, Scorpius was the scorpion whose sting killed Orion. In the sky Orion still flees from the scorpion, since Orion sets below the horizon as Scorpius rises.

The heart of Scorpius is marked by brilliant orange-red Antares, a name that means the rival of Mars (Ares).

North-east of  $\beta$  Scorpii, near the border with Ophiuchus, lies the brightest X-ray source in the sky, Scorpius X-1. This was the first X-ray source found outside the solar system.

A cluster of about twenty small stars around and including Antares is part of the Scorpio-Centaurus OB association, which is the closest aggregate of hot early-type stars to the Sun.

To find Scorpius look overhead in the late evening sky, and find orange-red Antares. Trace the sting and in the other direction, the three stars making the "head".

### Some stars and interesting objects in the Constellation

$\alpha$  Scoorpii (Antares, rival of Mars), is a red supergiant 330 light years away about 300 times the diameter of the Sun. It has a close 6th magnitude blue companion.

$\beta$  Sco (Graffias, crab) is a striking double star easily divisible in the smallest telescopes. The two blue-white stars are magnitude 2.6 and 4.9 and lie 540 light years away.

$\nu$  Sco, is a quadruple star system 550 light years away. A small telescope shows  $\nu$  Sco as a wide double, with blue-white companions of magnitude 4.0 and 6.3. Telescopes of 75mm and above reveal under high magnification that the fainter star is a close double of magnitude 6.8 and 7.8. The brighter star is an even closer double of magnitude 4.4 and 6.4. This last pair requires an aperture of over 150 mm to split them.

$\xi$  Sco is a celebrated multiple star 85 light years away. This interesting system consists of a bright yellow pair, unfortunately just past minimum separation and unresolvable at present. There is a

third star connected in a large orbit retrograde to the pair. In the same field 5' south-east is a smaller deep yellow pair with similar proper motion and radial velocity, indicating a physical connection.

M 4 (NGC 6121) is a large 7th magnitude globular cluster visible in binoculars. This beautiful cluster is crowded with stars running to a broad haze in the centre, across which is a bar of brighter stars. M 4 is the closest of all globular clusters to us at around 7,500 light years away.

M 6 (NGC 6405) the Butterfly Cluster, is an impressive 6th magnitude star cluster easily seen in binoculars, covering about the same area of the sky as the full Moon. The brightest member of the cluster is the orange-hued variable star BM Sco, which contrasts nicely with the other members of the cluster.

M 7 (NGC 6475) is a large, brilliant star cluster visible to the unaided eye, with an impressive diameter twice that of the Moon. Its 50 or so members are easily resolved in binoculars and small telescopes. The brightest stars are of magnitude 6 and appear to be arranged in chains.

M 80 (NGC 6093) is a small 8th magnitude globular cluster visible in binoculars or a small telescope, appearing like the fuzzy head of a comet. It lies about 36,000 light years away.

NGC 6231 is a large unaided eye glorious cluster of around 120 stars. It is a striking group for small telescopes. There are many bright white and yellow stars, and many pairs and triplets, which sparkle in patterns of lines and small groups. Its distance is estimated as 6000 light years. NGC 6231 is connected to a larger scattered cluster of fainter stars, visible in binoculars, called H 12, which lies to the north. The chain of stars linking NGC 6231 and H 12 outlines one of the spiral arms of our Galaxy.

NGC 6302 is a remarkable planetary nebula, popularly known as the "Bug Nebula". It is an elliptical or spindle-shaped bluish planetary nebula, with high surface brightness, appearing in a star-sprinkled field.

## GRAHAM LOFTUS: VIA E-MAIL

Graham Loftus died on Saturday May 16. Graham was famous among the older New Zealand astronomers. He had a great passion for astronomy, great abilities as a telescope mirror maker, and was an all-round nice bloke. Tributes and memories followed the news of Graham's passing.

Bob Evans first knew Graham when he lived in Christchurch and was an active member of the Canterbury Astronomical Society. Bob recalled:

"My vision of his driving his one cylinder Lantz tractor through 3 or 4 metre high old-man gorse at the newly acquired West Melton observatory site has never left me. His demonstration of cratering on the Moon using plaster of Paris meteoroids at a CAS meeting is another memory.

Then when Stefan Mochnacki and I visited Auckland in early January 1969 to bring Clive Rowe's photometer, it was Graham that put us

up. Like his telescopes, he was bigger than life."

Rod Austin recalled Graham as "One of the truly great characters of NZ astronomy. I had quite a bit to do with him when the Taranaki Active Astronomers Group was up and running, and he wrote several articles for the newsletter. Also of course in the days of Tikorangi Observatory and later the Cape Egmont Observatory. He made the mirrors for their big telescopes."

Stephen Hovell recalled that he and Graham "... used to see a lot of each other in the late 60s before I moved away from Auckland. I remember cherry brandies with Grant Christie at Lam while looking through his monster 20-inch."

Frank Andrews attended Graham's Funeral which was held at a private burial on Monday 25th May in the Waikato

## JUNE NIGHT SKY 2015

Venus, brilliant and silver, and golden Jupiter appear in the northwest quarter of the sky after sunset. Venus sets soon after 8 pm at the beginning of the month. Jupiter sets two hours later. Through the month Venus moves a little higher in the evening sky while Jupiter sinks lower. This brings them together. By the end of June they are only a full-moon's width apart. The thin crescent moon will be near them on the 20th. Though low, Jupiter is worth viewing in a telescope. Even binoculars will show one or two of its moons looking like stars close to the planet. Venus looks like a featureless first-quarter moon, similar in size to Jupiter. The close separation of the planets is a line-of-sight effect. At the end of the month, when the two planets appear close together Venus is 78 million km away and Jupiter is 910 million km away on the far side of the Sun.

Low in the west at dusk is Sirius, the brightest true star. It sets around 9 pm mid-month, twinkling like a diamond. Canopus, the second brightest star, is in the southwest. It is a 'circumpolar' star: one that never sets. Sirius appears bright both because it is 20 times brighter than the sun, and because it is relatively close at nine light years\*. Canopus, the second brightest star, is higher in the southwest sky, circling lower into the south later on. Canopus is 310 light years away and 13,000 times brighter than the sun.

Arcturus is a lone bright star in the northeast. Its orange light often twinkles red and green when it is low in the sky. It sets in the northwest in the morning hours.

Saturn, midway up the eastern sky, is the same brightness as Arcturus but cream-coloured. To its right but fainter, is orange Antares, the brightest star in Scorpius. A small telescope shows Saturn's rings and its biggest moon, Titan, about four ring-diameters from the planet. Other smaller moons appear as faint stars closer to Saturn. Saturn is 1350 million km away mid-month.

Crux, the Southern Cross, is south of the zenith. Beside it and brighter are Beta and Alpha Centauri, often called 'The Pointers' because they point at Crux. Alpha Centauri is the closest naked-eye star, 4.3 light years

away. Beta Centauri and many of the stars in Crux are hot, extremely bright blue-giant stars hundreds of light years away. They are members of a group of stars that formed together then scattered. The group is called the Scorpio-Centaurus Association.

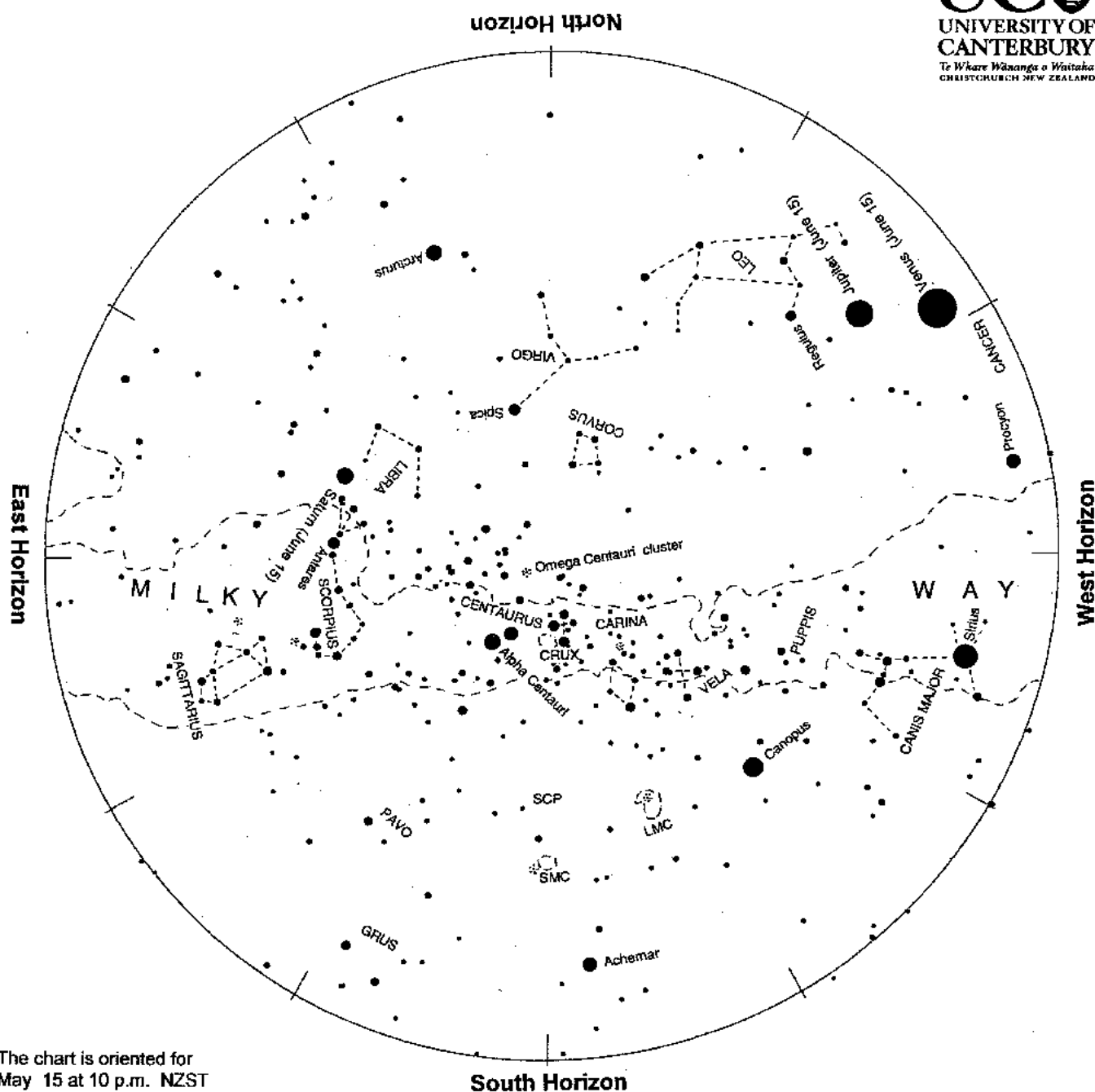
Antares, marking the scorpion's heart, is a red giant star: 600 light years away and 19 000 times brighter than the sun. Red giants are much bigger than the sun but much cooler, hence the orange-red colour. Though hundreds of times bigger than the Sun, Antares is only about 20 times the Sun's mass or weight. Most of the star's mass is in its hot dense core. The rest of the star is thin gas. Red giants are dying stars, wringing the last of the thermo-nuclear energy from their cores. Antares will end in a spectacular supernova explosion in a few million years. Below Scorpius is Sagittarius, its brighter stars making 'the teapot'.

The Milky Way is brightest and broadest in the southeast toward Scorpius and Sagittarius. It remains bright but narrower through Crux and Carina then fades in the western sky. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the sun is just one. The thick hub of the galaxy, 30 000 light years away, is in Sagittarius. A scan along the Milky Way with binoculars will find many clusters of stars and some glowing gas clouds. Relatively nearby dark clouds of dust and gas dim the light of distant stars in the Milky Way. This makes them look like holes and slots in the Milky Way. There is a well-known dark cloud called The Coalsack by the Southern Cross. It is around 600 light years away. The dust, more like smoke, comes off old red stars. These clouds eventually coalesce into new stars.

The Clouds of Magellan, LMC and SMC, in the lower southern sky, are luminous patches easily seen by eye in a dark sky. They are two small galaxies about 160 000 and 200 000 light years away. The Large Cloud is about 5% the mass of the Milky Way; the Small Cloud is about 3%.

\*A light year (l.y.) is the distance that light travels in one year: nearly 10 million million km or 10<sup>13</sup> km. Sunlight takes eight minutes to get here; moonlight about one second. Sunlight reaches Neptune, the outermost major planet, in four hours. It takes sunlight four years to reach the nearest star, Alpha Centauri





The chart is oriented for  
May 15 at 10 p.m. NZST  
June 1 at 9 p.m. "  
June 15 at 8 p.m. "  
July 1 at 7 p.m. "

### Evening sky in June 2015

To use the chart, hold it up to the sky. Turn the chart so the direction you are looking is at the bottom of the chart. If you are looking to the south then have 'South horizon' at the lower edge. As the earth turns the sky appears to rotate clockwise around the south celestial pole, SCP on the chart. Stars rise in the east and set in the west, just like the sun. The sky makes a small extra westward shift each night as we orbit the sun.

Venus and Jupiter appear in the northwest quarter soon after sunset. Venus sets soon after 8 pm and Jupiter two hours later in early June. Jupiter moves closer to Venus through the month so the two planets make a close pair at the end of June. Sirius twinkles colourfully in the west before setting. Canopus is in the southwest. South of overhead are the Pointers, Alpha and Beta Centauri, with the Southern Cross (Crux) to their right. Saturn is high up the eastern sky with orange Antares to its right. Antares is the centre of the Scorpion, on its back, with the Sagittarius 'teapot' below it. Orange Arcturus, low in the north, often twinkles red and green.