



Wellington Astronomical Society February 2016 Volume 46 Issue 1
 WWW.WAS.ORG.NZ, ISSN 01147706 - PRINT, ISSN 2230-5912 ONLINE

The next WAS meeting will be held on Wednesday 3rd of February 2016 at 7:30 pm at Carter Observatory, Upland Rd, Kelburn, Wellington

Pictures from radio waves: how are images of astronomical radio sources constructed?

Duncan Hall



Picture sourced from National Radio Observatory (http://www.nrao.edu/pr/2010/magstream/Mag_Stream_Radio_Combo_labels_new.jpg)

The guest speaker at this month's meeting will be Duncan Hall, and his talk will be on how the signals from astronomical radio sources are used to build up images.

Duncan will cover the fundamentals of synthesising images from astronomical radio signals, how arrays of antennas are used to capture radio signals, and some of the less well known engineering considerations and constraints to radio astronomy imaging.

Inside this issue:

| | |
|---|---|
| Stardate SI (South Island) | 3 |
| NACAA XXVII | 3 |
| Variable Stars South Symposium | 3 |
| 2016 RASNZ Conference | 3 |
| WAS Volunteers at Space Place | 4 |
| Foxton / Horowhenua star party | 4 |
| Total Solar Eclipse 2016 Indonesia tour | 4 |
| 2016 Crafoord Prize | 4 |
| 'Goto' Telescope Gotchas | 5 |
| Star Trail Imaging | 6 |
| February Night Sky Chart | 8 |
| The Night Sky in February | 9 |

2015 — 2016 SUBSCRIPTIONS DUE

The new subscription year began in September, so WAS looks forward to receiving your subscription renewal.

Renewal forms can be found on the website, but a summary follows:

Subscription for Newsletter by Email 2015-2016

Adult/Waged: \$ 50.00

Student/Unwaged: \$ 30.00

Family: \$ 70.00

Payment methods:

Cheque - make out to Wellington Astronomical Society Inc, and mail to PO

Box 3181, Wellington 6140

Direct Deposit or Internet Banking - use Acc No: 03-0502-0508656-00, please include reference so WAS knows who is making the payment

Cash - please bring exact amount to meeting

WAS COUNCIL MEMBERS AND CONTACTS

Council Members

The following members were elected to Council at the Nov 2015 AGM

President: Antony Gomez

Vice President: Duncan Hall

Secretary/Telescope custodian: Chris Monigatti

Treasurer: John Homes

Website (joint): John Homes & John Talbot

Councilors

Frank Andrews

Janine Bidmead

Peter Graham

Aline Homes

Murray Forbes

James Smith

Peter Woods

Newsletter Editor: editor@was.org.nz

Postal Address: Wellington Astronomical Society, PO
Box 3181, Wellington 6140, New Zealand

Stardate SI (South Island)

Stardate South Island will be held at the beautiful dark sky site in Staveley. Bunk accommodation is available as well as a camp site for those feeling a little more adventurous.

A large number of telescopes are always present, and historically conditions have been excellent over the weekend. This years guest speaker is Dr. Grant Christie from the Stardome Observatory, Auckland.

Dates: 5-8th February 2016

Venue: Staveley.

Further information: <http://www.treesandstars.com/stardate/>

NACAA XXVII

This coming Easter, NACAA XXVII, the 27th National Australian Convention of Amateur Astronomers, will be held in Sydney.

Amateur astronomers from across Australia and New Zealand will be meeting to share their knowledge on a broad range of topics including variable stars, astroimaging, spectroscopy, occultations, outreach, comet hunting, history, citizen science, pro-am collaboration, and much more.

Programme highlights include:

- Two days packed with presentations
- Variable Stars South Symposium (see following item)
- Trans-Tasman Symposium on Occultations
- Workshop on image processing with PixInsight

- Conference Dinner with guest speaker Fred Watson
- Behind the scenes tour of historic Sydney Observatory

Registration packages range from just a half day to all four days.

Dates: Easter 2016

Venue: University of Sydney

Enquiries: <http://nacao.org.au>

Variable Stars South Symposium

The 4th Variable Stars South Symposium will be held in Sydney on Easter Friday, 25th March 2016.

The venue is the University of Sydney's Law Building (Camperdown Campus) which is centrally located, with good transport links, and plenty of accommodation options nearby.

The event is being held in conjunction with the 27th National Australian Convention of Amateur Astronomers, NACAA XXVII, which will run over the entire Easter Weekend. Chair of the Programme Committee is David O'Driscoll.

Dates: Easter Friday, 25th March 2016

Venues: University of Sydney's Law Building (Camperdown Campus)

Enquiries: David O'Driscoll (Chair of the Programme Committee)

2016 RASNZ Conference

The 2016 RASNZ Conference will be held in Napier from Friday May 20 to Sunday 22 May. It will be followed by an Astrophotography Workshop on Monday 23rd and the morning of Tuesday 24th.

You don't need to be a RASNZ member to attend, anyone is welcome. How-

ever, RASNZ members qualify for a discount, so joining up may be worthwhile.

Usually 80 – 100 participants attend these conferences, so it pays to book accommodation early. Details are available at [http://rasnz.org.nz/Downloadable/](http://rasnz.org.nz/Downloadable/Conference/2016%20RASNZConference%20Brochure.pdf)

[Conference/2016%20RASNZConference%20Brochure.pdf](http://rasnz.org.nz/Downloadable/Conference/2016%20RASNZConference%20Brochure.pdf).

NOTE: WAS will be hosting the 2020 RASNZ conference in Wellington. If you would like to be involved in the local organizing committee, please contact Antony Gomez or Chris Monigatti.

WAS volunteers at Space Place

We would like to thank all WAS members who have volunteered to help with the Cooke Telescope on observing nights over the last few years. This arrangement has saved WAS a significant sum of rental payment for society meetings. Starting from December 2015 we now have a new agreement with Wellington Museums Trust. WAS meetings

will still be at Space Place – in return, WAS members will be asked to assist WMT staff with public outreach events, manning telescopes and answering questions about Astronomy. We will give as much notice of these events as possible in the newsletter and at meetings. If you think these would be fun to be involved

in, please contact Antony Gomez or Chris Monigatti .

Foxton / Horowhenua star party

Sigurd Magnusson has sent us links to a video and pictures he took at the Foxton / Horowhenua star party.

The link to the video is <https://vimeo.com/150495210> and the link to the pictures is <https://www.flickr.com/photos/sigurd/albums/72157655352528115>.

According to his email, the last nine photographs are from the star party, taken with a sony A7.

Total Solar Eclipse 2016 Indonesia tour

WAS has received an email from Amar A. Sharma, an Indian amateur astronomer. He is running a tour to view the 2016 solar eclipse from Indonesia.

If anyone is interested, details can be found here <http://www.astronamartours.com/international-tours/indonesia-total-solar>.

2016 Crafoord Prize

On January 14, the Royal Swedish Academy of Sciences awarded the Crafoord Prize in Astronomy for 2016 jointly to Roy Kerr, University of Canterbury, Christchurch, New Zealand, and Roger Blandford, Stanford University, CA, USA.

In 1963, Roy Kerr successfully solved Einstein's equations for rotating black holes, the only type that can actually

exist in the universe. In 1977, Roger Blandford explained how rotating black holes are powerful emitters of radiation, and has continued to refine the models used to explain how gravitational energy from the black holes affects the gas surrounding them.

The prize was awarded to both men "for fundamental work concerning rotating black holes and their astrophysical

consequences" and is worth six million Swedish krona, or a little over one million New Zealand dollars. The Crafoord Prize award ceremony is to be held at the Royal Swedish Academy of Sciences on 26 May 2016.

'Goto' Telescope Gotchas

Recently I got the use of an early 'Goto' telescope (a Meade LX200). These types of telescope require the user to do an alignment procedure before they will correctly 'goto' a star. For this telescope it consists of a two-star alignment using Sigma Octantis (the Southern Hemisphere's Pole star) and another bright star (chosen by the telescope based on its location and the current time and date). The telescope automatically slews to where it 'thinks' each star is and asks you to centre the telescope on the star, to fine-tune the telescope's coordinates. When things go right, the star you need to centre on should be the only bright star visible in the finder-scope.

However, it immediately became clear something was wrong as the telescope would sometimes point at the ground for the second star. The 'fine-tuning' to centre on the star could be an adjustment of up to 90°. Even worse, after doing this alignment the telescope still wouldn't correctly 'goto' other stars.

Once I finished swearing, I went back and read the manual again – but this time very carefully. I finally figured out what I'd done wrong and now have the alignment procedure on the telescope working correctly. I've written this little note to describe below what I did wrong, in the hope of saving someone else suffering the same headache.

To do the alignment procedure, the telescope needs to know its location on the Earth's surface, i.e. its longitude and latitude. Many modern 'goto' telescopes have a GPS system built-in, which will automatically get this information. However, in earlier models like the LX200, the user has to manually enter it. Fortunately, I have a GPS unit as part of my occultation observing equipment and entered the following coordinates for my observatory;

Latitude = $-41^{\circ} 10'$, Longitude = $174^{\circ} 58'$

This was my first mistake – as the longitude reported by my GPS system increases when moving to the east of Greenwich (Greenwich Observatory in the UK is the zero position of the longitude coordinate). However, the LX200 telescope (and probably other Meade telescopes) uses a longitude system that increases when moving to the west of Greenwich. I should have entered;

Longitude = $185^{\circ} 02'$ (= $360^{\circ} - 174^{\circ} 58'$)

With the longitude I'd first entered, the telescope 'thought' it was to the north-east of the Chatham Islands rather than Lower Hutt.

The next pieces of information the telescope needs to do the alignment are the local time and date, and the time-zone. These only need to be entered once, as the telescope runs a clock from an internal battery (so it keeps track of the time even when the telescope is turned off). The time-zone is then subtracted (by the telescope) from the local time, to calculate the time at Greenwich (Greenwich Mean Time – GMT – or Universal Time – UT). For New Zealand, our time zone is -12 hours. I'd found this quite confusing, as some maps showed our time-zone as +12 and others as -12, and initially I didn't know which system the telescope was using. Further, every six months I'd need to change to/from daylight-saving with a corresponding change in the time-zone (and I still haven't figured out if that should be -11 hours or -13 hours).

Fortunately, I found in the manual that you can set the time and time-zone as if you were at Greenwich and everything will still work okay (even though I'm on the opposite side of the world from Greenwich). So I set the time-zone to 0 hours and entered UT (which is reported by my GPS occultation unit) as the local time. This has the added advantage that I don't need to worry about adjusting for daylight-saving. Now I finally have a telescope where the alignment procedure and subsequent 'goto's work correctly.

My next step is to see if I can connect my laptop to the telescope and run the telescope via a planetarium program (C2A) but that may be the subject of another article at a later date.

Happy New Year,

Murray Forbes.

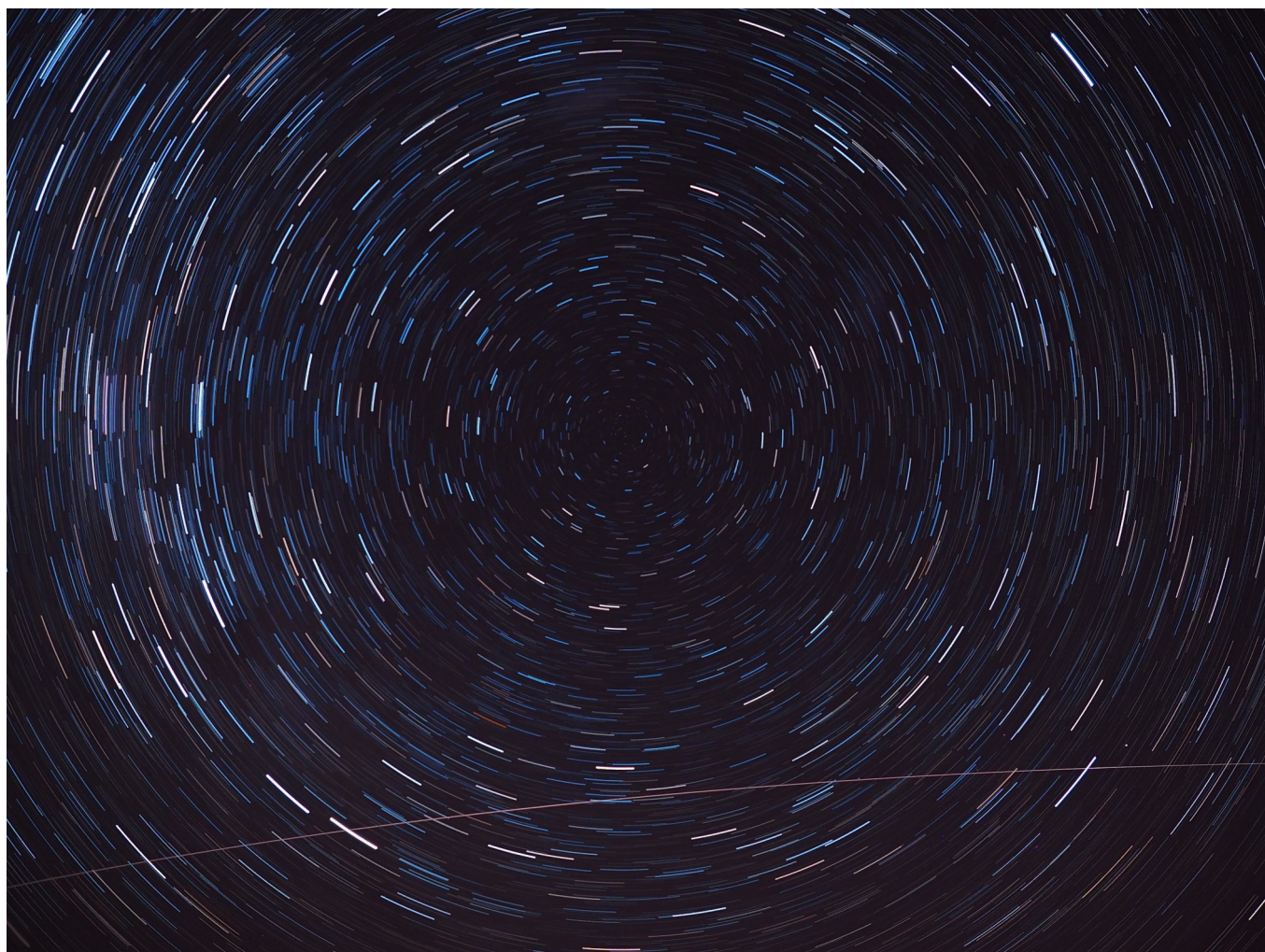
Star Trail Imaging

What are star trails? Star trails are the continuous paths created by stars, produced during time-exposure images.

As Earth rotates on its tilted axis, the stars appear to move. When a camera captures that movement, that's called a star trail. The Earth rotates once relative to the backdrop stars in a period of 23 hours and 56 minutes. So, as seen from Earth, all the stars go full circle and return to the same place in sky after this period of time, referred to as the sidereal day.

Star trail imaging is straight-forward, but can be time-consuming. In the days of film photography, cameras could be set on 'bulb' to record a 15 – 30 min image with stars trailing. The early sensors in digital cameras were too sensitive to electronic and thermal noise to take images of more than 60 seconds at high ISO. Thus, star trailing required taking many shorter consecutive images and using software such as **Registax** or **PhotoShop** to stack or layer images to produce a combined star trail image.

Olympus' OM-D EM-1 mirror-less micro four-thirds digital camera has features that make star trail imaging much easier. Using the 'Live composite' setting, the camera takes a series (ISO, exposure time, aperture set by user) of consecutive images that are combined in camera, and displayed live on the LCD. So, producing a 30 minute trail image takes only 30 minutes from start to final image. Another useful Olympus feature is that the image only includes 'new light' ie: from the apparent star movement – any bright tree or building in the foreground is only 'counted' once.



'Rotation' around the South Celestial Pole (ISS passing through image)

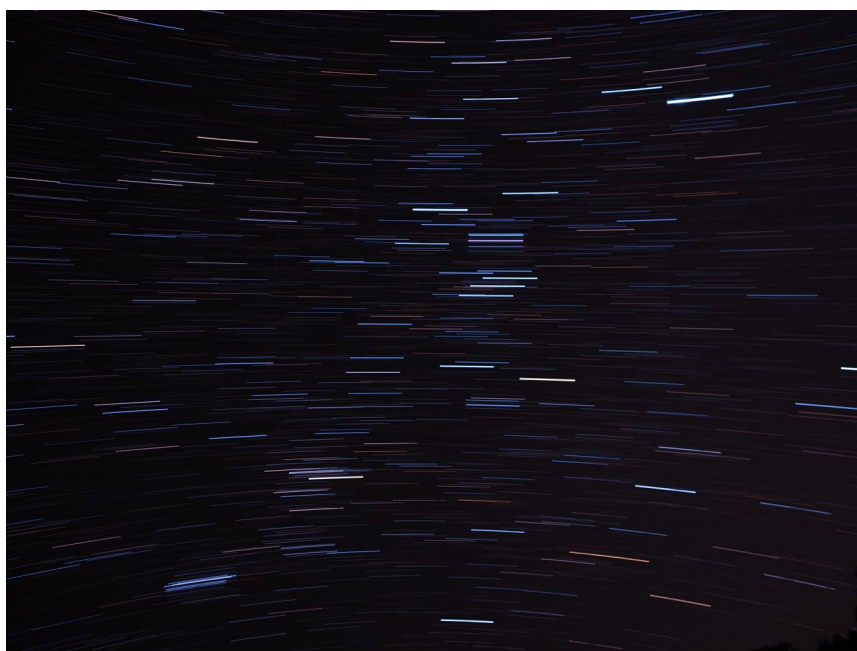
Tips for star trails:

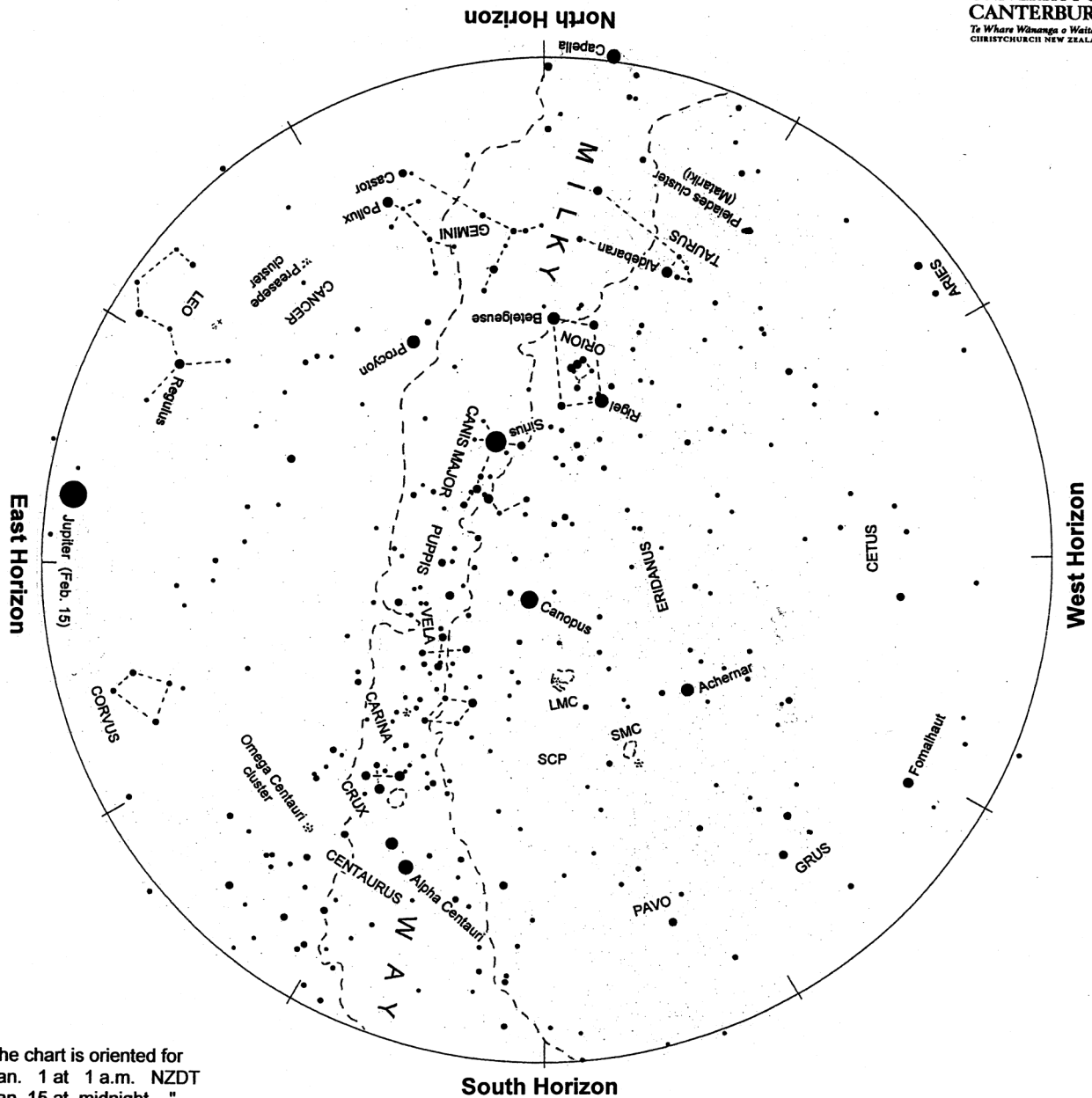
- avoid Moon light
- get away from city lights – south coast or Makara are great
- sturdy tripod, camera with fully-charged battery, 'fast', wide-angle lens
- foreground object (tree, building, hill) if possible
- point at South Celestial Pole (uppermost picture below) or bright star region such as Orion (lowermost picture below)

Chris Monigatti (based on <http://earthsky.org/space/what-are-star-trails>)



Star trailing is possible from the city before true darkness





The chart is oriented for
 Jan. 1 at 1 a.m. NZDT
 Jan. 15 at midnight "
 Feb. 1 at 11 p.m. "
 Feb. 15 at 10 p.m. "

Evening sky in February 2016

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.

Jupiter is the 'evening star'. It appears due east in the late evening at the beginning of the month. It rises earlier each night so is up at dusk most of the month. Sirius, the brightest star, appears north of overhead at dusk. Canopus, the second brightest star, is south of the zenith. Orion, containing 'The Pot', is midway up the north sky. Below and left of Orion are Taurus and the Pleiades/Matariki star cluster. The Southern Cross and Pointers are midway up the southeast sky. The Clouds of Magellan, LMC and SMC, two nearby galaxies, are high in the south sky.

The Night Sky in February

In February bright stars are nearly overhead. **Sirius**, the brightest star, is north of the zenith. **Canopus**, the second brightest star, is south of the zenith. Below and left of Sirius are Orion's bright stars: bluish **Rigel** and reddish **Betelgeuse**. Between them is the line of three stars making Orion's Belt. The Belt line points left and down to orange **Aldebaran**, the eye of Taurus the Bull. Continuing the same line finds a tight bunch of fainter stars making the **Pleiades/Matariki** star cluster.

In the late evening, at the beginning of the month, **Jupiter** rises due east. It is brighter than any of the stars and shines with a steady golden light. Later on Jupiter is already up at dusk, appearing in the eastern sky soon after sunset. Any telescope will easily show Jupiter's four bright moons. They were first seen by Galileo in 1610. Binoculars, steadily held, often show one or two. Jupiter is 680 million km from us mid-month. The planet is 11 times Earth's diameter and 320 times Earth's mass. The full moon appears close to Jupiter on the 24th.

Sirius, 'the Dog Star', marks the head of **Canis Major** the big dog. A group of stars above and right of it make the dog's hindquarters and tail. **Procyon**, in the northeast below Sirius, marks the smaller of the two dogs that follow Orion the hunter across the sky. Sirius is eight light years* away.

Below and left of Sirius are **Rigel** and **Betelgeuse**, the brightest stars in **Orion**. Between them is a line of three stars: Orion's belt. To southern hemisphere star watchers, the line of three makes the bottom of 'The Pot'. The handle of the pot is Orion's sword. The Orion Nebula at its centre; a glowing gas cloud many light-years across and around 1300 light years away.

The belt stars point to orange **Aldebaran**. It is at one tip of a V-shaped pattern of stars making the face of **Taurus** the bull. The V-shaped group is called the Hyades cluster. It is 130 light years away. Orange **Aldebaran**, Arabic for 'the eye

of the bull', is not a member of the cluster but merely on the line of sight, half the cluster's distance from us.

Low in the northwest is the **Pleiades** or **Matariki** star cluster, also known as the Seven Sisters and Subaru. Six stars are seen by most eyes. Dozens are visible in binoculars. The cluster is 440 light years from us. Its stars formed around 100 million years ago. From northern New Zealand the bright star **Capella** is on the north skyline. It is the sixth brightest star in the sky.

Crux, the Southern Cross, is in the southeast. Below it are Beta and **Alpha Centauri**, often called 'The Pointers'. Alpha Centauri is the closest naked-eye star, 4.3 light years away. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light years away. **Canopus** is also a very luminous distant star; 13 000 times brighter than the sun and 300 light years away.

The **Milky Way** is brightest in the southeast toward Crux. It can be traced up the sky, fading where it is nearly overhead. It becomes very faint east or right of Orion. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the sun is just one.

The Clouds of Magellan, **LMC** and **SMC** are high in the south sky, easily seen by eye on a dark moonless night. They are two small galaxies about 160 000 and 200 000 light years away, nearby for galaxies. The Large Cloud is about 5% the mass of the Milky Way galaxy; the Small Cloud about 3%.

At dawn all the bright planets are visible. Golden Jupiter is midway up the northwest sky. Reddish Mars is in the northeast of the zenith. Creamy-white Saturn is midway up the eastern sky. Above Saturn but fainter is the orange star Antares, the heart of Scorpius. Brilliant Venus is lower in the east. Mercury is below and right of Venus. Mars, Saturn and Mercury are the same brightness, roughly. The moon is near Mars on the

morning of February 2nd; near Saturn on the 4th; and passing the region of Venus and Mercury on the 6th and 7th.

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

Notes by Alan Gilmore, University of Canterbury's Mt John Observatory, P.O. Box 56, Lake Tekapo 7945, New Zealand.

www.canterbury.ac.nz