Wellington Astronomical Society September 2016 Volume 46 Issue 8
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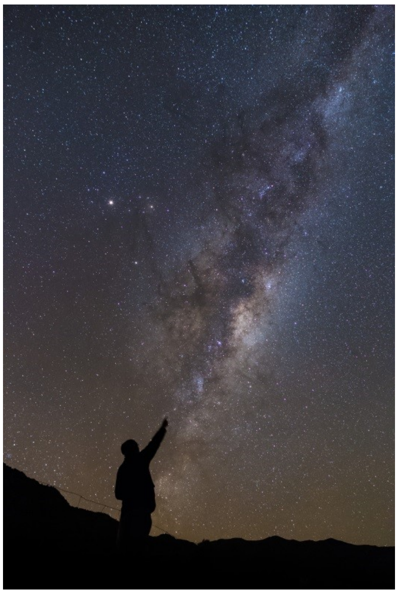
The next WAS meeting will be held at 7:30 pm, Wednesday 7th of September at Carter Observatory, Upland Rd, Kelburn, Wellington

WAS Meeting Talk - Imaging the Night Sky

Speakers: Edward Wilcock and Jim McAloon



Wainui Coast Rd – Edward Wilcock

We have two astrophotographers who will present different aspects on imaging the night sky.
Edward Wilcock is relatively new to the world of astrophotography taking it up at school just a few years ago and is now producing some spectacular images of the Milky Way. He will discuss how he got started in this field and show some of his images he has taken including some time-lapse photography shot at a few of the WAS public outreach events this year.

Jim McAloon is a more experienced astrophotographer who specialises in imaging Solar System objects. He will discuss the techniques he uses and present some of his work. He won an award at for the 2016 RASNZ Astrophotography competition in May this year. (Images from the 2016 RASNZ Astrophotography competition can be viewed at https://www.youtube.com/watch?v=4OCzLHNaxko).

Inside this issue:

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

Peter Woods

Newsletter Editor: editor@was.org.nz

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

WAS ON FACEBOOK

Our Facebook page Wellington Astronomical Society is now operational. You can search for it on Facebook or click on this link https://www.facebook.com/WellingtonAstronomicalSociety/. If you are a Facebook user please use the page to receive up to date notifications of our Society's events and news. This is the easiest way to be informed as to what is going on in the Society as well as keeping up with astronomical news. You will need to interact occasionally with the page by liking / commenting on postings or indicate whether you are coming to an event. Otherwise Facebook will, after a time, no longer send you the new postings. So keep visiting the page as there are a number of Society events coming up in the next few months.

We also have Facebook group WAS – Wellington Astronomical Society (https://www.facebook.com/groups/96304353012/) which is open for anyone to join by request. The public group is open for discussion or postings on astronomical news.

Wellington Astronomical Society September 2016 Events

WAS September Meeting

We have two astrophotographers who will present different aspects on imaging the night sky.

Edward Wilcock is relatively new to the world of astrophotography taking it up at school just a few years ago and is now producing some spectacular images of the Milky Way. He will discuss how he got started in this field and show some of his images he has taken including some time-lapse photography shot at a few of the WAS public outreach events this year.

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Images from the 2016 RASNZ Astrophotography competition can be viewed at https://www.youtube.com/watch?v=4OCzLHNaxko

Date: Wednesday, 7th Septemebr

Time: 7:30 PM

Venue: Space Place, Carter Observatory

WAS Observing Evening

Come along and see the many wonderful objects, star clusters, galaxies, dying stars and nebulae around and near the Southern Cross, Mars, Saturn and the Moon.

Date: Saturday, 10th September

Time: 7:00 PM

Venue: Tawa College

Astronomy Club Night

A short presentation and observing the night sky. Anyone is welcome to join in.

Date: Thursday, 8th September

Time: 7:00 PM

Venue: Hutt International Boys School

Astronomy Club Night

A short presentation and observing the night sky. Anyone is welcome to join in.

Date: Thursday, 15th September

Time: 7:00 PM

Venue: St Bernard's College, Lower Hutt

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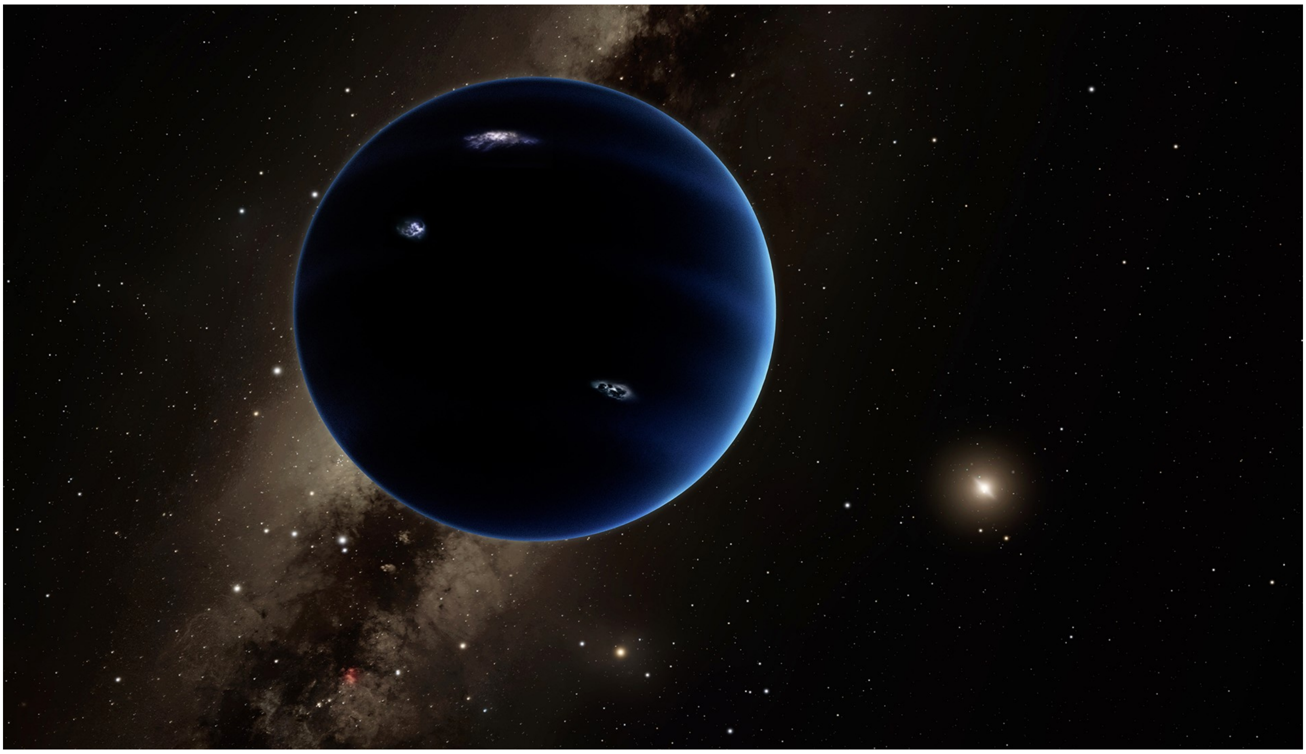
Is there a super-Earth in the Solar System out beyond Neptune?

This article is provided by NASA Space Place.

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.

Visit **spaceplace.nasa.gov** to explore space and Earth science!



A possible super-Earth/mini-Neptune world hundreds of times more distant than Earth is from the Sun. Image credit: R. Hurt / Caltech (IPAC)

When the advent of large telescopes brought us the discoveries of Uranus and then Neptune, they also brought the great hope of a Solar System even richer in terms of large, massive worlds. While the asteroid belt and the Kuiper belt were each found to possess a large number of substantial icy-and-rocky worlds, none of them approached even Earth in size or mass, much less the true giant worlds. Meanwhile, all-sky infrared surveys, sensitive to red dwarfs, brown dwarfs and Jupiter-mass gas giants, were unable to detect anything new that was closer than Proxima Centauri. At the same time, Kepler taught us that super-Earths, planets between Earth and Neptune in size, were the galaxy's most common, despite our Solar System having none.

The discovery of Sedna in 2003 turned out to be even more groundbreaking than astronomers realized. Although many Trans-Neptunian Objects (TNOs) were discovered beginning in the 1990s, Sedna had properties all the others didn't. With an extremely eccentric orbit and an aphelion taking it farther from the Sun than any other world known at the time, it represented our first glimpse of the hypothetical Oort cloud: a spherical distribution of bodies ranging from hundreds to tens of thousands of A.U. from the Sun. Since the discovery of Sedna, five other long-period, very eccentric TNOs were found prior to 2016 as well. While you'd expect their orbital parameters to be randomly distributed if they occurred by chance, their orbital orientations with respect to the Sun are clustered extremely narrowly: with less than a 1-in-10,000 chance of such an effect appearing randomly.

Whenever we see a new phenomenon with a surprisingly non-random appearance, our scientific intuition calls out for a physical explanation. Astronomers Konstantin Batygin and Mike Brown provided a compelling possibility earlier this year: perhaps a massive perturbing body very distant from the Sun provided the gravitational "kick" to hurl these objects towards the Sun. A single addition to the Solar System would explain the orbits of all of these long-period TNOs, a planet about 10 times the mass of Earth approximately 200 A.U. from the Sun, referred to as **Planet Nine**. More Sedna-like TNOs with similarly aligned orbits are predicted, and since January of 2016, another was found, with its orbit aligning perfectly with these predictions.

Ten meter class telescopes like Keck and Subaru, plus NASA's NEOWISE mission, are currently searching for this hypothetical, massive world. If it exists, it invites the question of its origin: did it form along with our Solar System, or was it captured from another star's vicinity much more recently? Regardless, if Batygin and Brown are right and this object is real, our Solar System may contain a super-Earth after all.

Ethan Siegel

Leap Second on 2016 December 31

Great news – this summer longer than usual!

The International Earth Rotation and Reference Systems Service, Paris Observatory, advise that a positive leap second will be introduced at the end of December 2016. The sequence of dates of the UTC second markers will be:

2016 December 31, 23h 59m 59s
2016 December 31, 23h 59m 60s
2017 January 1, 0h 0m 0s

The difference between UTC and the International Atomic Time TAI is:
from 2015 July 1, 0h UTC, to 2017 January 1 0h UTC : UTC-TAI = - 36s
from 2017 January 1, 0h UTC, until further notice : UTC-TAI = - 37s

Website http://gdso.webs.com

From the official announcement, forwarded by Howard Barnes. Reproduced from RASNZ newsletter.

Chris Monigatti

Wellington Astronomical Society Annual General Meeting Reminder

Just an early reminder that the Wellington Astronomical Society Annual General Meeting will be held on Wednesday 2 November, at Space Place at Carter Observatory, beginning at 7:30pm. The WAS council will be advising in the October newsletter of several motions that will be presented to members:

- Classes of membership – create a new class that applies to members who live too far away to attend meetings and events. Wording of the amendment is being finalised. (see later article for more details).
- The registered office of WAS should be updated from the existing:

REGISTERED OFFICE

20.(1) The registered office of the Society shall be situated at

Carter Observatory,

Botanic Gardens,

40 Salamanca Road,

WELLINGTON

To:

Space Place at Carter Observatory,

Botanic Gardens,

40 Salamanca Road,

WELLINGTON 6012.

If you would like to be more involved in the running of our society or events that we host, then you can:

- stand for the WAS council – nominations and seconder to secretary@was.org.nz at least 14 days before the AGM
- volunteer to be part of the 'Local organizing committee' – LOC – for the 2020 RASNZ conference in Wellington
- talk to Antony Gomez, Janine Bidmead or Chris Monigatti about joining us at outreach events.

Chris Monigatti

Wellington Astronomical Society Outreach Activities

Island Bay Cubs – Thursday 11 August

Chris Monigatti and Peter Woods took scopes out to the Scout Hall in Island Bay on a very clear, calm and cold evening. About 20 cubs and ten parents enjoyed looking at Jupiter, Mars, Saturn and a quarter Moon.

Chris Monigatti

Wellington Waterfront – Thursday 18 August

To 'celebrate' a chance to see all five naked-eye planets at one time, we took scopes down the bridge at Frank Kitts park. A good number of passers-by were encouraged by Janine to stop and look (only one asked "what's the catch?"). We had lots of positive feedback, and some observers had been to earlier events and following our events on Facebook. Despite light pollution and tall buildings obscuring parts of the sky the event was very enjoyable and well worth repeating. Thanks to members Janine, Casey, Sarah, Antony, Edward, and others for four fun hours.

Chris Monigatti

Five Planets – Wellington Waterfront 18th August)

World Space Week – October 4th to 10th

The World Space Week this year will run from October 4th to the 10th. The choice of dates was based on recognition of two important dates in space history: the launch of the first human-made Earth satellite, Sputnik 1, on October 4, 1957; and the signing of the Outer Space Treaty on October 10, 1967 (Wikipedia).

The theme of the week will be '*Remote Sensing: Enabling our Future*'. WAS events will be detailed in the October newsletter.

Chris Monigatti

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Beatrice Hill Tinsley Lecture

On Tuesday 12 July, WAS and Carter Observatory Space Place hosted the annual Beatrice Hill Tinsley lecture, given by Dr Michael Person, of MIT's Planetary Astronomy Laboratory. Dr Person's work is based on using occultations to study minor planets and Trans-Neptunian Objects, and his topic was the first found and most famous TNO, Pluto.

Dr Person began with the discovery of Pluto in 1930, and what was known about it prior to 2015, which was not a lot. It is small and distant, and our best telescopes could only just detect that there were some markings, without showing detail, and one large moon. Studies of occultation events showed that Pluto does have an atmosphere, and the Hubble Space Telescope detected two more, tiny, moons.

Then in 2015, Pluto was due to occult another star, about a week before the New Horizons spacecraft arrived. It was originally believed that the event path would go to the south and east of New Zealand, but shortly beforehand, it was confirmed that the event would be visible from parts of New Zealand, and occultation observers up and down the country were ready.

Dr Person arrived in Christchurch with the SOFIA flying observatory, to try and observe from the expected centre line of the event, which was still to be off the coast. On the day, this led to a rather strange flight course, as the flight crew, still receiving,last minute updates from NASA, tried to put the aircraft is the right place at the right time. They succeeded, and Dr Person got his observations.

The occultation observations, both from SOFIA and from ground based observers, provided a great deal of information about Pluto's atmosphere. Dr Person gave us a brief overview of the results. He was particularly pleased that he had managed to record the central spike of the light curve, caused by refraction in Pluto's atmosphere.

Then Dr Person went on to the New Horizons results, and the remarkable landscapes they showed, on Pluto itself and its moon Charon. There is evidence that some of Pluto's terrain is very recent, and may still be being reworked. Transmission from New Horizons is very slow, and we still have not received everything it has observed.

The New Horizons results do not render the occultation observations obsolete. They show a lot about Pluto's atmosphere that New Horizons does not have the instrumentation for.

In discussing occultations, Dr Person mentioned one thing that may have surprised a few people. A so-called Solar Eclipse is not an eclipse, but an occultation. May I say So There?

John Holmes

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Remit to WAS AGM - proposed changes to classes of membership

Moved;

"The 'Associate Membership' be renamed 'Unwaged Membership', to better reflect the meaning of this membership class.

And

"A new membership class ('Associate Membership') be introduced, to apply to people who live too far away from Wellington to be able to attend the society's functions."

Specifically, replace the existing clauses with the following *(changes shown in italics)*;

3.1(b)

"Financial Member" shall mean any Ordinary Member, *Unwaged Member*, Associate Member and Family Membership whose subscription is fully paid for the current year and has no subscription arrears due to the Society. All Life Members shall be deemed to be Financial Members. Each Family Membership shall be deemed to be not more than two Financial Members.

4(2)

Members may be either Ordinary Members, *Unwaged Members*, Associate Members, Family Members, Honorary Members, or Life Members.

4(5)

Unwaged Membership shall be open to full time students and to beneficiaries.

5(1)

Any person wishing to become an Ordinary, *Unwaged*, Associate, Family or Honorary Member of the Society shall fill in an application form which shall be forwarded to the Membership Secretary. The membership Secretary shall bring before Council all such applications, and unless any objection is raised by a member of the Council the applicants shall be admitted to membership.

16(7)

The quorum for all General Meetings of the Society shall be calculated from the total number of all Ordinary, *Unwaged*, Associate, Family and Life Members of the Society. This quorum will be either 25% of the total number or 25 such Members, whichever is the lesser amount. No business shall be transacted at any General Meeting unless a quorum is present at the commencement of such a meeting. If within 30 minutes from the time appointed for the holding of the meeting a quorum is not present, then the meeting shall stand adjourned to the next scheduled normal meeting date, place, and time, and if at the adjourned meeting a quorum is not present within 30 minutes from the time appointed for the meeting the number of persons present and entitled to vote at the expiration of that time shall constitute a quorum.

And add the following new clause;

4(8)

Associate Membership shall be open to persons who live at such distance from the venues of Society functions that they are unable to regularly participate in Society activities. Such distance being decided from time to time by the Council. An associate member shall be entitled to all the privileges of membership except the right to stand for election to Council.

Murray Forbes

Colour Codes from the Stars, Part 2 - Visible Colours

Let us start with the fascinating magnet. We readily sense its field of influence, 'magnetic field'; farther is weaker. This strong-weak is a measure of magnitude. Incredible inventions use moving magnets to make electricity (ie a generator), whilst changing electricity moves magnets (ie a motor). This association is '*electro-magnetic*'; one change causes the other. A fluctuating field is a 'wave'. This doesn't mean it's jumping up and down in space; the strength just keeps changing strong-weak repeatedly.

As a different kind of waves to sound, water, string, or seismic, an electro-magnetic (EM) wave is a changing electric field with its associated magnetic field. Its strength/magnitude fluctuates cyclically with time –eg 50 times per second or 50 Hz (Hertz) for household electricity.

Just like a hi-fi equipment display of sound 'frequency' components, from *Bass (low frequency) through to Treble (high frequency),*

EM waves are commonly shown in Hz, plotted 1 interval = 10 times higher:

10, 100, 1k, 10k, 100k, 1M, 10M, 100M, 1G, 10, 100G, 1T
(50 Hz, AM-FM radio, HF, VHF, microwave, infrared, red—violet, ultraviolet, x-ray, gamma ray,…)

'Light' is just a small part of this range. Some lights are not visible to humans: ultra-violet is of higher frequency than violet and infra-red is of lower frequency than red.

Along a path that the field strength/magnitude fluctuates, a measurement can be made from one point of maximum strength to the next. This is a measure of length, therefore 'wavelength', in Angstrom, nm, cm, etc. The same information above can be shown as wavelengths (higher frequency = shorter wavelength). See http://imagine.gsfc.nasa.gov/science/toolbox/spectra1.html

A dewdrop on a blade of grass, especially a round drop, shows with sparkling clarity all colours of the rainbow, ROYGBIV (VIBGYOR). If you cannot see bright violet and deep red, try a more peripheral angle.

The sunlight's spectrum can tell us what happened at the sun about 8 minutes earlier, as light took that long to get here. The sun is a star. Another star's light shows similar colours and can tell us what was going on there. Remember… what is seen of an object x light-years distance away happened x years ago.

Basic equipment

Just like a dewdrop that shows sunlight's component colours, a prism can be used, or a (glass) transmission grating that is mounted with threads just like for a filter.

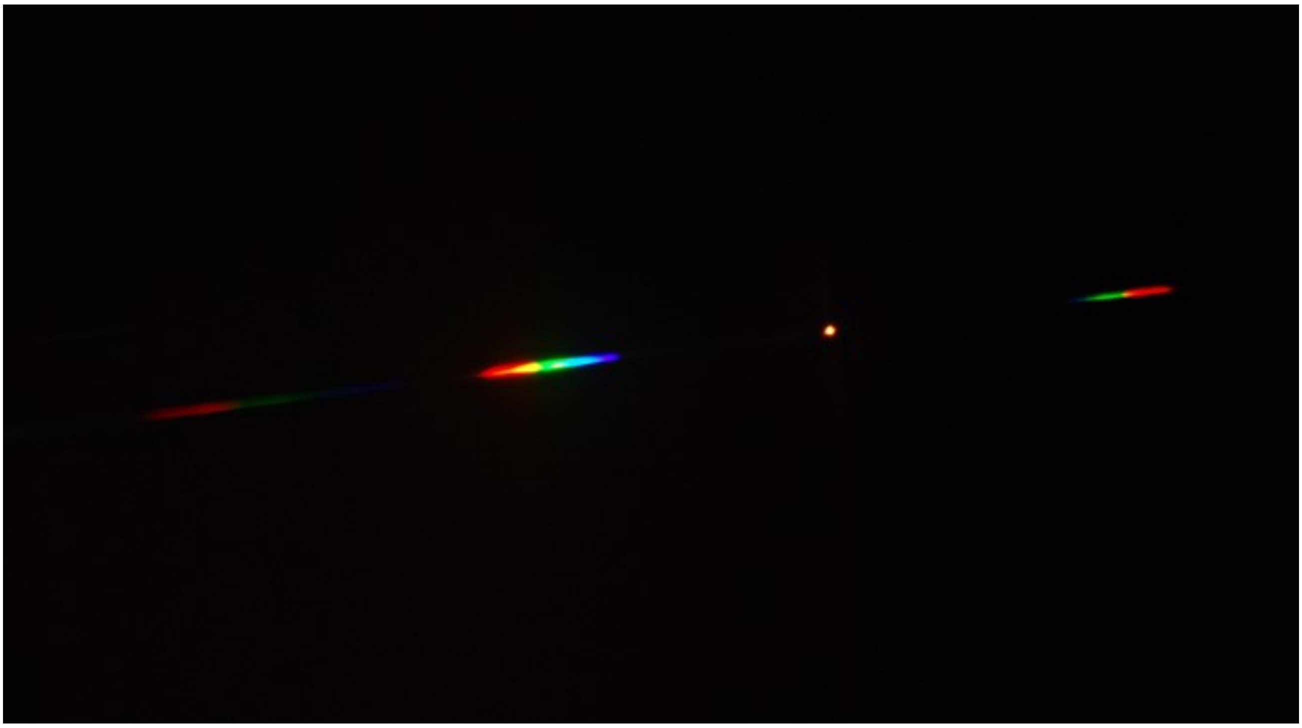
Examples are shown in Pictures 1a – 1d (A mention does not necessarily imply endorsement. Please research). Rainbow Optics (2 versions: a two-piece Visual/Photo/CCD and a one-piece Visual) has a cylindrical lens that stretches the thin-line star spectrum

Pictures 1a-b. Two versions of the Rainbow Optics grating [Ref 1]

Pictures 1c-d. SA100 and SA200 gratings [Ref 2]. Local enquiry [Ref 3]

Observing an astronomical spectrum is as basic as general observing with a filter, with a camera or a telescope.

Sometimes we see double rainbows. Similarly, but by a different process, transmission gratings (see-through) and reflection gratings (angled arrays of mirror surface show a light source's multiple-order spectra), Picture 2.



Picture 2. At the eyepiece, Betelgeuse, SA100, Credit: Malcolm Locke, NZ, with permission

A point-light star gives a (very) thin band of spectrum. Broader band are often seen displayed, because:

a) If a cylindrical lens is used, it stretches the image broader (but fainter!), similarly to a lens ruler that magnifies a line of text.

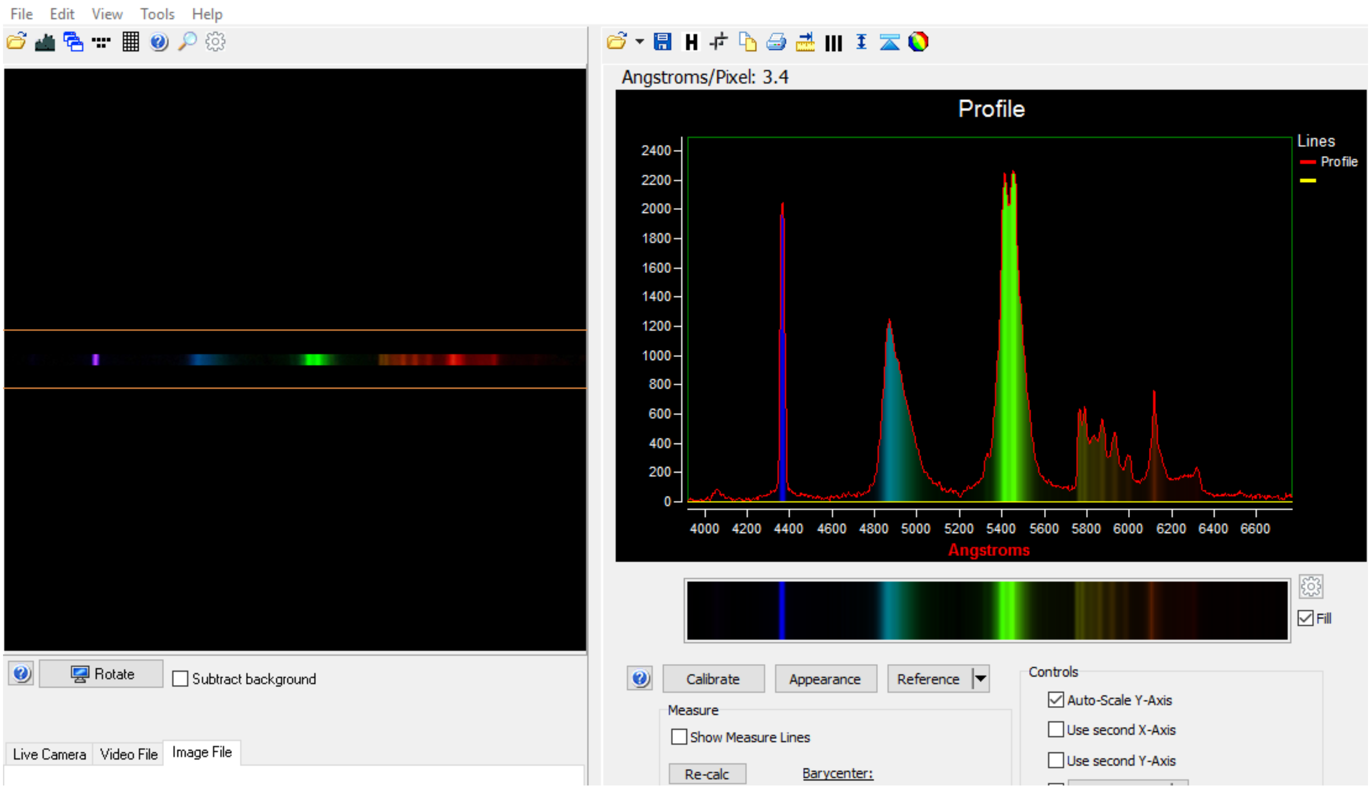
b) If without tracking, by setting the grating for the spectrum to lie perpendicular to the drift, imaging the star drift smears a narrow spectrum into a band.

c) For imaging with tracking, the resultant bright narrow spectrum (repeatedly exposed at the sensor) can be regenerated by software to show a wide band.

From image to graph

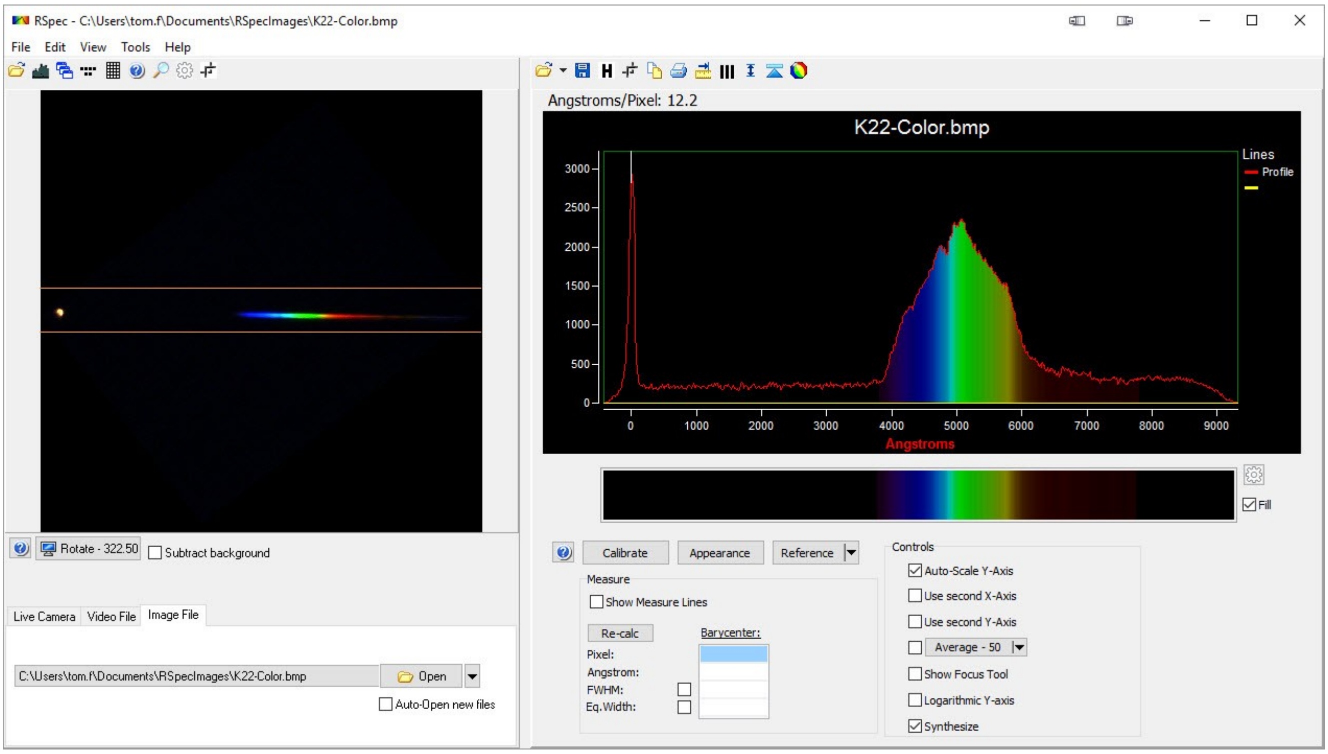
Such an image can be further processed. Black-and-white imaging is generally preferred, to maximise resolution (colours can be later synthesised). There is freeware (VSpec, ISIS, BASS), and the low-cost RSpec with free-trial.

In Part I of this series, a plastic grating showed CFL lamps' spectra. A cropped image from the 'Warm' CFL is graphed using RSpec in Picture 3.



Picture 3. Illustrative only, display on RSpec by the author. CFL original by Mark Justice

Similarly, Picture 4 graphed a star spectrum. Note the button ‘Live Camera’ for real time display from a video-cam.

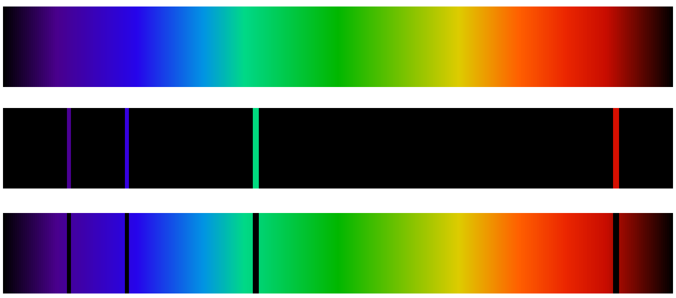


Picture 4. Vega spectrum using RSpec. Supplied by Tom Field [Ref 4]

A celestial object’s spectrum may show:

- a band of colours (continuum) from a hot solid object,
- bright lines (emission), a hot gas emits light at specific wavelengths,
- dark vertical lines (absorption), a cooler gas absorbs light at specific wavelengths,
- broadening interpreted as a Doppler shift effect,
- changes with time eg from binary stars, comets, novae.

See https://en.wikipedia.org/wiki/Astronomical_spectroscopy .

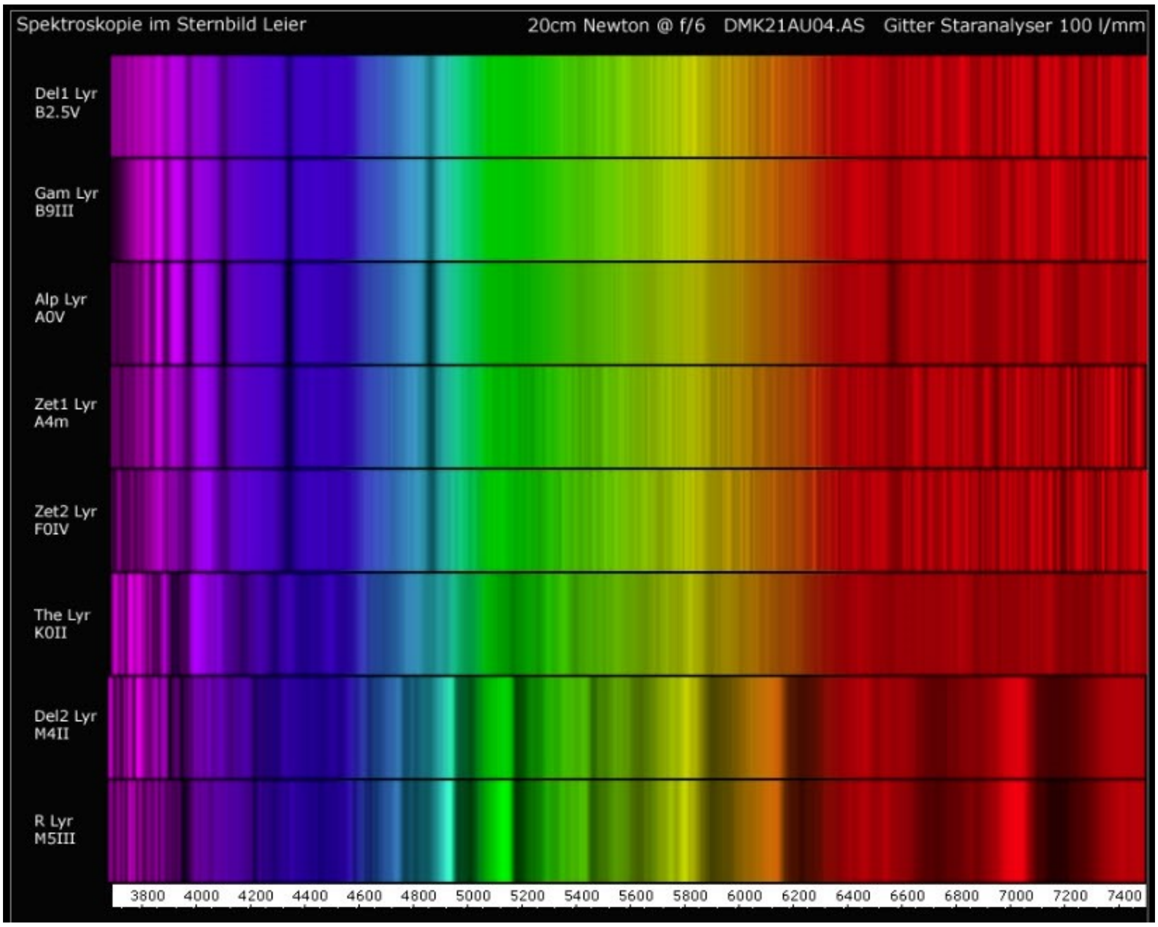


Pictures 5a-c Continuum, Emission, Absorption. Credit: Stkl Public Domain, https://commons.wikimedia.org/w/index.php?curid=42405328 (and -29 and -27)

Introductory Observing List.

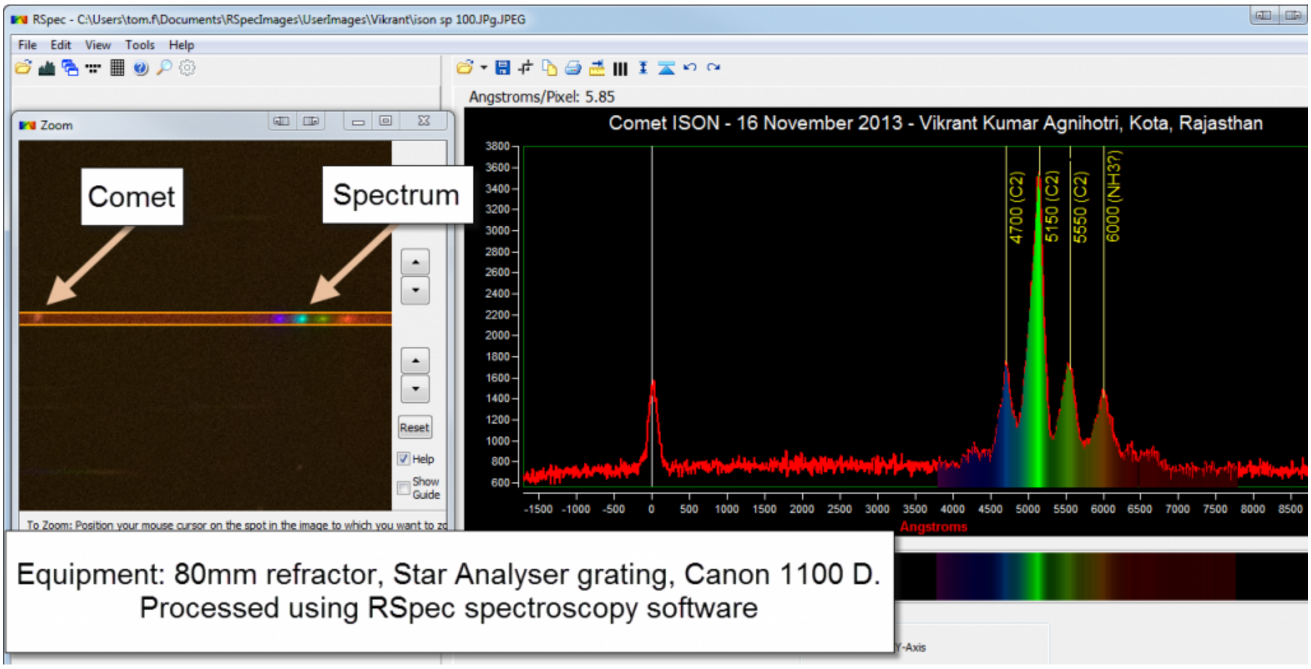
Stars are classified based on features of their spectra, examples in Picture 6.

Special southern-sky objects are: Gamma Velorum ‘Spectral Gem’, Theta Muscae, Eta Carinae. See also http://www.atlasoftheuniverse.com/stars.html The Brightest Stars, Spectral Types.



Picture 6. Stellar classification examples. [Ref 5, details in original image] with permission

With proper calibration, analysis can yield much information. See Picture 7, and examples in [Ref 5]: Albireo, a nova, a Wolf Rayet star, carbon stars.



Picture 7 Comet ISON [Ref 5] with permission.

Pro-Am Spectroscopist Malcolm Locke, NZ, relates:

- Amateur spectroscopy "top-heavy" globally. Need more southerners.
- Opportunity for real scientific contribution

References

[1] http://www.starspectroscope.com/index.html and https://www.optcorp.com/manufacturer/rainbow-optics-spectroscope

[2] http://www.patonhawksley.co.uk/resources/Star_Analyser_100_Instructions_v1-6.pdf and http://www.patonhawksley.co.uk/resources/STAR_ANALYSER_200_INSTRUCTIONS_v1-2.pdf

[3] http://www.bintel.com.au/Accessories/Spectroscopy/154/catmenu.aspx

[4] http://www.rspec-astro.com/setupdownload/ currently with a workshop video

[5] www.rspec-astro.com/sample-projects

Resources

https://youtu.be/Fv5fFSacVO8 How to capture star spectra in your backyard, 7.5 mins Tom Field, 2016

https://www.youtube.com/watch?v=6IMJglnz2Uw Different Types of Spectra, 5 mins, P E Robinson, 2013

http://www.spectro-aras.com/forum/viewtopic.php?p=6816 Workshop 2016

Submitted for newsletters of Astronomical Societies in Australia and New Zealand by Sky C Murphy and Team at Southskyscience

Emailed Newsletter circulation method survey

Most of you will have 'received' this newsletter via email. More precisely, I will have emailed you a notice about where you go on our website to download the newsletter.

We adopted this method of circulating the newsletter some years back, when few people had broadband so it took several minutes to download the file. With this procedure, you could choose when you wanted to do this download rather than have it forced upon you when you read your email. The downside was that the process of putting the newsletter on the website and then telling you about that added a day's delay in getting the newsletter into your hands.

However now-a-days most (all?) people who have email use a broadband connection and the download only takes a few seconds. So the question is; do you want to continue with the current circulation method or would you prefer to have the newsletter emailed directly to you?

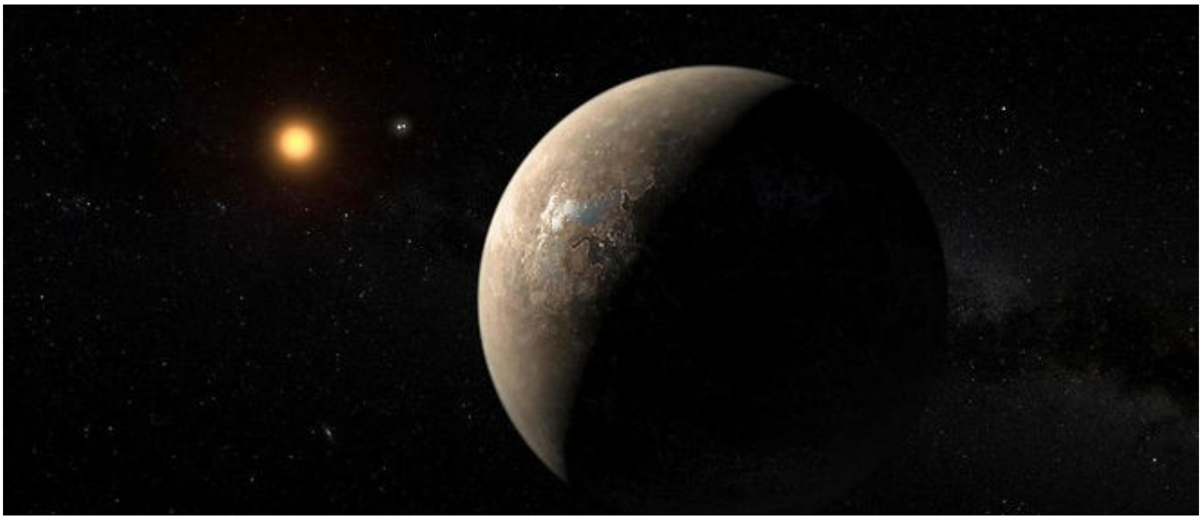
Please let me know via email which method ('via website' or 'direct email') you prefer.

Cheers,

Murray Forbes

murray_forbes@xtra.co.nz

Discovery of nearest extra-solar planet



Proxima b - Artist impression – space.com

As reported in Nature, a team of international scientists have detected an extra-solar planet orbiting Proxima Centauri. The team made the discovery by analysing data obtained from the European Southern Observatory in Chile. Since Proxima Centauri is the sun's closest stellar neighbour, the new discovery is currently the closest extra-solar planet to the Earth, and has been given the name Proxima Centauri α.

Proxima Centauri was discovered in 1915, by Robert Innes, a Scottish astronomer, who at that time was the director of the Union Oservatory in South Africa. The main reason for the star's relatively late discovery is that it is extremely faint (apparent magnitude of around 11.05) and is much too dim to be seen by the naked eye. It is classed as a Type M red dwarf, which are known for emitting flares that can cause significant fluctuations in their brightness.

When the distance to Proxima Centauri was determined, it was found to be significantly closer to the sun than the Alpha Centauri double-star system (4.25 light years as opposed to 4.37). It therefore replaced Alpha Centauri as the closest star to the sun, leaving Alpha Centauri as the closest star system to the sun. It is believed that Proxima Centauri may be a third component of the Alpha Centauri system, but it has not been possible to confirm this, due to the large separation between it and the other members of the system. At approximately 15,000 AU (1 AU = average distance between the earth and the sun), Proxima Centauri would take around 500,000 years to orbit the other members of the Alpha Centauri system. It will therefore take some time to assess whether or not it is orbiting with them, or if it is completely independent.

The discovery was made by identifying changes in the wavelength of the light emitted by the star. Although stars are considerably more massive than planets, a star with planets will undergo very slight changes in position. For example, when a planet orbiting a star is between the Earth and the star, the star is pulled slightly towards the Earth, when the planet is on the opposite side of the star, the star is pulled slightly away from the Earth. These motions introduce a Doppler effect in the wavelengths of the star's spectrum, moving towards the Earth decreases their frequency (blue shift), moving away increases them (red shift).

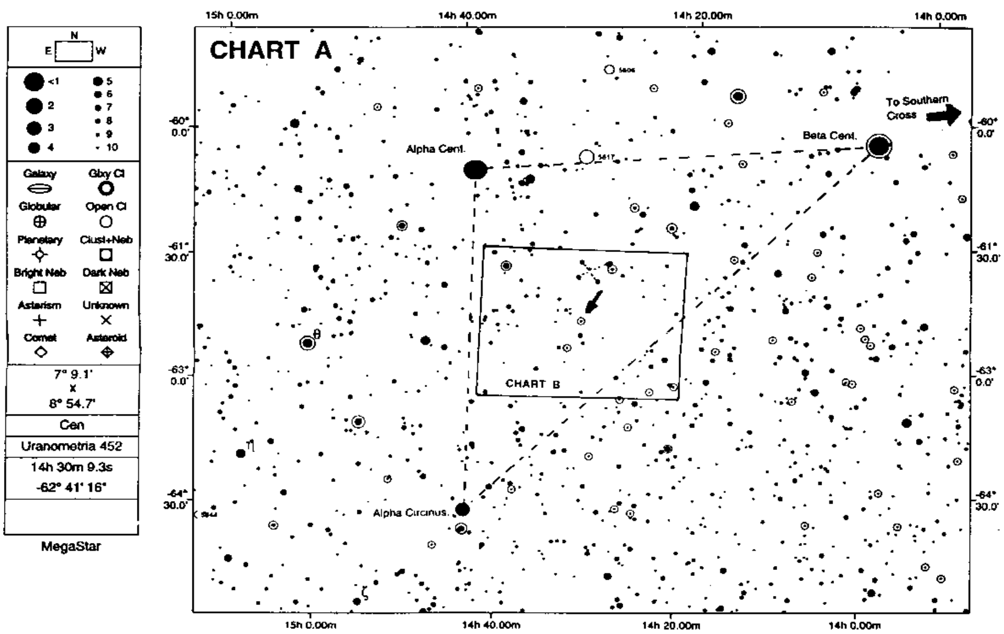
This Doppler effect takes a lot of effort to measure, and it was only after a fairly intensive effort earlier this year that the team felt capable of verifying the discovery. However, it not only confirms the presence of a planet orbiting Proxima Centauri, but allows reasonable estimates of its mass (1.3 that of Earth's), orbital period (about 11.2 Earth days) and its proximity to the star (0.02 AU).

This last point is particularly interesting, as it puts the planet within the "habitable zone" for Proxima Centauri: in other words, the distance from the star that would allow water to exist in its liquid form. As this is believed to be one of the main criteria for the evolution of life, it is possible that the planet could support living organisms, or have done so some time in the past. However, there is currently no actual evidence of liquid water or even an atmosphere on the planet, flares from Type M stars like Proxima Centauri can be intense enough to strip any orbiting planets of any existing oceans or atmosphere, and the planet is believed to be "tidal-locked" with one hemisphere continually facing the star and the other in perpetual darkness. All of these conditions are believed to be inimical to the formation of life, although it is not clear by what degree, or how far the planet's situation actually corresponds to them.

To answer these and other questions, study of the planet will continue. Within the next ten years, astronomers are hoping to have witnessed an occultation of Proxima Centauri by the planet, or perhaps even have obtained direct images (possibly via a space telescope). This information, combined with other studies, should give us a much clearer picture of the conditions on the planet, and its potential for habitability. Even if life appears unlikely on the planet, any information gained will be valuable for investigating similar objects and the systems they are part of.

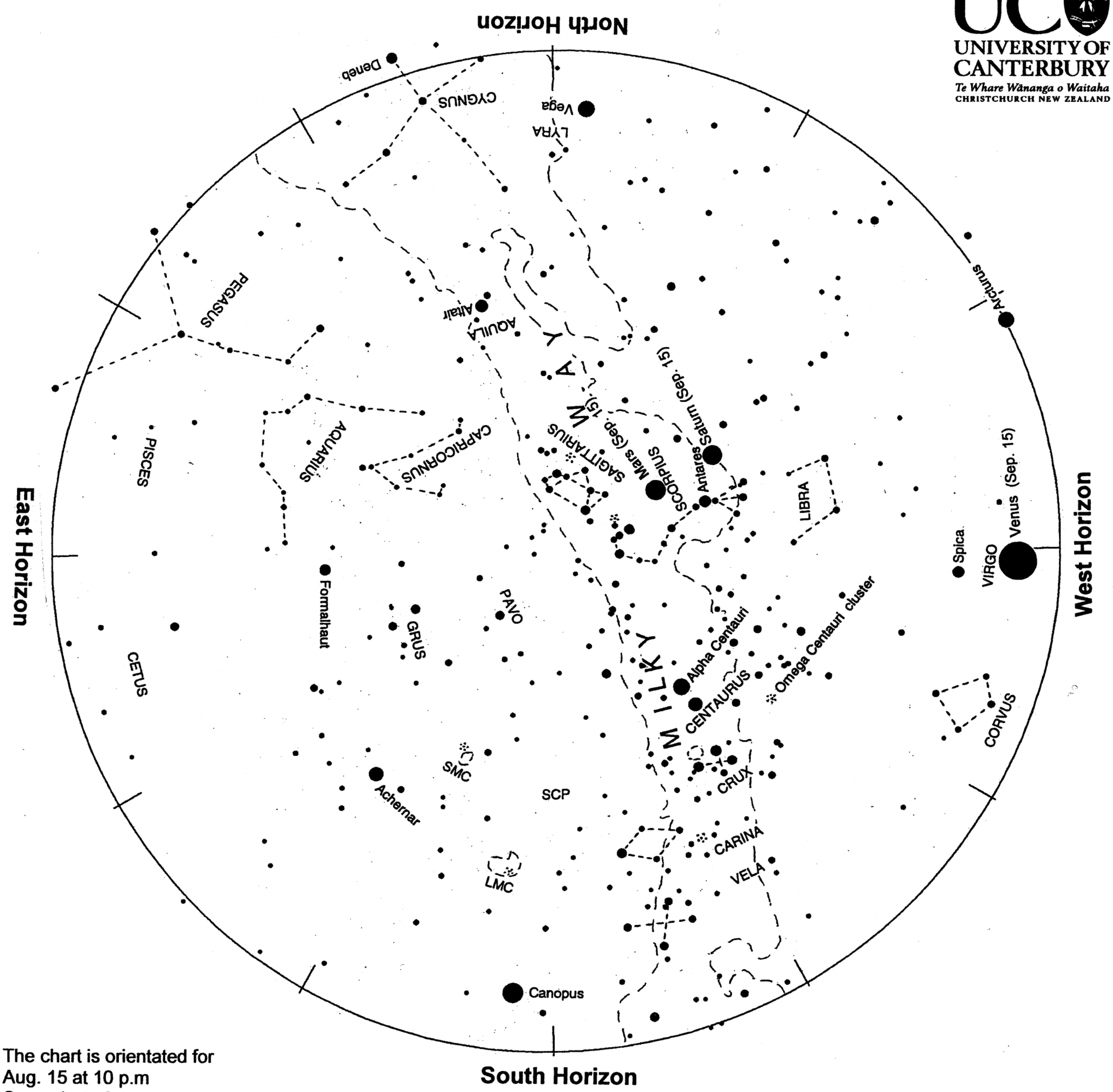
Gerard Coyle (with information from the Guardian newspaper international edition, and other sources)

Position of the red dwarf Proxima Centauri considered to be part of the Alpha Centauri system (top-centre star). Beta Centauri (top-right star)



Finder chart for Proxima Centauri (downloaded from http://aswa.info/images/charta.gif)

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND



The chart is orientated for
Aug. 15 at 10 p.m
Sep. 1 at 9 p.m.
Sep. 15 at 8 p.m.

Evening sky in September 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 clockwise rotation each night as we orbit the sun.

Venus is the brilliant silver 'evening star' low in the west at dusk. Golden Jupiter and Mercury (not shown) are below it at the beginning of the month but soon slip lower and disappear in the twilight. Orange Mars and cream-colored Saturn are west of the zenith, near orange Antares the Scorpion's heart. The Scorpion's tail, a.k.a. the fish-hook of Maui, curls toward the zenith. Arcturus twinkles red and green as it sets in the northwest. Crux, the Southern Cross, and the Pointers are in the south-west. Canopus twinkles like a diamond near the southern horizon. Vega shines on the opposite horizon. The Milky Way spans the sky from north to south.

Chart produced by Guide 8 software; www.projectpluto.com. Labels and text added by Alan Gilmore, Mt John Observatory of the University of Canterbury, P.O. Box 56, Lake Tekapo 7945, New Zealand. www.canterbury.ac.nz

The Night Sky in September

All five naked-eye planets are visible in the evening sky at the beginning of the month. Mercury, Venus and Jupiter are low in the west, setting 90 minutes after the Sun. Venus is the brightest, with golden Jupiter below it. Mercury is fainter and left of the bright pair. (Jupiter and Mercury are not shown on the chart.) Venus remains the 'evening star' while Jupiter and Mercury slip into the twilight over the following nights. We are leaving Jupiter behind on the far side of the Sun. Venus is catching us up. Mercury is passing between us and the Sun. The thin crescent Moon will be between Jupiter and Venus on the 3rd. At the beginning of the month Mercury is 104 million km from us, Venus 230 million km, Jupiter 960 million km.

Orange Mars and cream-coloured Saturn are northwest of the zenith at dusk. Orange Antares is on their left and fainter. Saturn stays near Antares as both drift lower through the month. Mars holds its elevation night-to-night so moves upward away from Saturn. Saturn is worth a look in any telescope. Good binoculars will show it as an oval, the planet and rings blended together. It is 1530 million km away mid-month. Mars is 146 million km away and tiny in a telescope. The first-quarter Moon will be below Saturn and Mars on the 9th.

Arcturus is on the northwest skyline. Canopus, the brightest true star in the sky, skims along the southern skyline. Both stars are shining through a lot of air which makes them twinkle colourfully. Canopus, being white, shows all colours like a diamond. Orange Arcturus twinkles red and green. Canopus is matched on the northern skyline by Vega, the second-brightest northern star after Arcturus.

Canopus is a truly bright star: 13 000 times the sun's brightness and 300 light years* away. Vega is 52 times brighter than the sun and 25 light years away.

From northern New Zealand the star Deneb can be seen near the north skyline in the Milky Way. It is the brightest star in Cygnus the Swan. Deneb is around 1400 light years away and 50 000 times brighter than the Sun.

Orange Antares, left of Saturn, marks the body of the Scorpion. The Scorpion's tail hooks toward the zenith like a back-to-front question mark. It is the 'fish-hook of Maui' in Maori star lore. Antares is a red giant star: 600 light years away and 19 000 times brighter than the sun. It is a relatively cool 3000 C, hence its red-hot colour. Below or right of the Scorpion's tail is 'the teapot' made by the brightest stars of Sagittarius. It is upside down in our southern hemisphere view.

Midway down the southwest sky are 'The Pointers ', Beta and Alpha Centauri. They point down to Crux the Southern Cross. Alpha Centauri is the third brightest star. It is also the closest of the naked eye stars, 4.3 light years away. Beta Centauri, along with most of the stars in Crux, is a blue-giant star hundreds of light years away.

The Milky Way spans the sky from north to south. It is brightest and broadest overhead in Scorpius and Sagittarius. In a dark sky it can be traced down past the Pointers and Crux into the southwest. To the northeast it passes Altair, meeting the skyline right of Vega. 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, 27 000 light years away, is in Sagittarius. The actual centre is hidden by dust clouds in space. At the very centre is a black hole four million times the sun's mass. Dust clouds near us appear as gaps and slots in the Milky Way. Binoculars show many clusters of stars and some glowing gas clouds in the Milky Way.

The Large and Small Clouds of Magellan, LMC and SMC, look like two misty patches of light in the south sky. They are easily seen by eye on a dark moonless night. They are galaxies like our Milky Way but much smaller. The LMC is about 160 000 light years away; the SMC about 200 000 light years away.

On moonless evenings in a dark sky the Zodiacal Light is visible in the west. It is a faint broad column of light surrounding Venus and extending upward toward Libra. It is sunlight reflecting off meteoric dust in the plane of the solar system. The dust may have come from a big comet, many centuries ago.

*A light year (l.y.) is the distance that light travels in one year: nearly 10 million million km or 1013 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.

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