Wellington Astronomical Society July 2016 Volume 46 Issue 6
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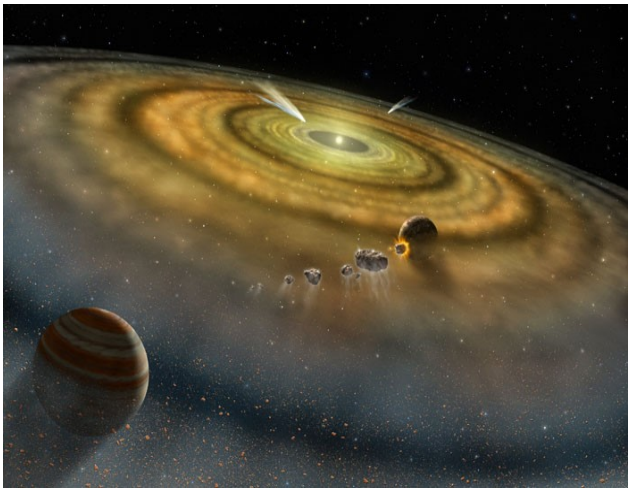
The next WAS meeting will be held at 7:30 pm, Wednesday 6th of July at Carter Observatory, Upland Rd, Kelburn, Wellington

WAS Meeting Talk - Exoplanets: Facts and Fancies

Dr Ed Budding



The talk comprises three main parts:
1. a general summary on exoplanets;
2. a review of a few Kepler objects that have been studied in detail, particularly regarding their photometry; and
3. a short section on planet-based life, that leans more to the 'fancies' side of the title.

Ed Budding is a former secretary of WAS, Deputy Director of Carter Observatory for 14 years and Acting Director for a year. While at Carter Observatory he did some photometry work. In more recent years, he has been doing similar kinds of things at the University of Canakkale in the Troad region of modern Turkey. A fair amount of the work he will present was carried out in Canakkale.

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 July 2016 Events

WAS July Meeting

The talk for the July meeting is Exoplanets: Facts and Fancies by Dr Ed Budding. See front page for more details.

Date: Wednesday, 6th July
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, the Magellanic Clouds, Mars, Jupiter and its moons, Saturn and its rings.

Date: Saturday, 2nd July
Time: 7:00 PM
Venue: Tawa College

Beatrice Hill Tinsley 2016 Lecture tour - The Science of Pluto

The year 2015 was truly the "Year of Pluto". From the arrival of the historic New Horizons mission to the numerous dedicated Earth-based campaigns to examine Pluto near the flyby epoch, we potentially learned more about Pluto in 2015 than in all of the years since its discovery. During the weeks preceding the New Horizons flyby, a dedicated observation campaign was undertaken in New Zealand and parts of Australia to study Pluto's atmosphere using the technique of stellar occultation, available only when Pluto passes directly in front of a star. A key component of this campaign was the Stratospheric Observatory for Infrared Astronomy (SOFIA), a converted 747 with a 2.5-m telescope, which was based out of Christchurch for these events.

Dr. Michael Person of MIT will discuss the history of Pluto science starting with the discovery of Pluto, through the discovery and characterization of its atmosphere and moons, to provide context to the discoveries of 2015. Focusing on his own experiences aboard the SOFIA aircraft, and the New Horizons flyby, he will discuss the explosion of Pluto knowledge over the last year, and its context in our understanding of the outer solar system.

Dr. Michael Person is a Research Astronomer in MIT's Planetary Astronomy Laboratory, and Director of MIT's George R. Wallace Astrophysical Observatory. He specializes in the observational techniques needed to observe occultations, eclipses, and transits, including high-precision astrometry, and high-time-resolution photometry. His science interests include identifying and characterizing the atmospheres, compositions, and figures of distant solar-system bodies, particularly Triton, Pluto, and Kuiper Belt Objects. Dr. Person received his education at MIT (Massachusetts Institute of Technology, Cambridge, MA) where he received a Bachelor's degree in Physics, as well as Masters and Doctoral degrees from the Department of Earth, Atmospheric, and Planetary Sciences. He trained in observational techniques and occultation science under the mentorship of the late Prof. James Elliot, one of the pioneers of modern occultation astronomy. Dr. Person's current research focuses on the atmospheres of Pluto and Triton, and the use of the SOFIA (Stratospheric Observatory for Infrared Astronomy) observatory and other assets to identify and monitor their changes.

This event is free for Wellington Astronomical Society members. Please bring your membership card and come early as we expect to have a large attendance from the public.

Date: Tuesday, 12th July
Time: 6:00 PM
Venue: Space Place, Carter Observatory

Details: http://rasnz.org.nz/rasnz/beatrice-hill-tinsley-lectures

Journey to Mars - A talk by Dr Dava Newman, second in command at NASA

Since NASA captured the first close-up images of Mars in 1965, we have been collectively fascinated by the Red Planet. To discover the possibilities for past or present life on Mars, NASA's Mars Exploration Program is currently following an exploration strategy known as "Seek Signs of Life." Learn more about the Journey to Mars and just what the Mars Curiosity Rover is up to, up there in space, directly from NASA Deputy Administrator Dr Dava Newman.

Appointed to her role by President Barack Obama in 2015, Dr Newman with NASA Administrator Charles Bolden provide overall leadership, planning, and policy direction for NASA.

This talk is being held in partnership with the US Embassy and Consulate in New Zealand and NASA. **Unfortunately this event has already sold out.**

Date: Tuesday, 12th July

Time: 6:00 PM

Venue: Victoria University of Wellington - Kelburn Campus, MacLaurin Building Lecture Theatre: MCLT 103.

Astronomy club night - Hutt International Boys School

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

Date: Thursday, 14th July

Time: 7:00 PM

Venue: Hutt International Boys School.

Astronomy club night - St Bernard's College

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

Date: Thursday, 28th July

Time: 7:00 PM

Venue: St Bernard's College, Lower Hutt

Stellarfest 2016

Horowhenua Astronomical Society (Inc) will be hosting the 5th Annual Stellarfest at Foxton Beach Bible Camp over the weekend of 29th to 31st July 2016. Witness the splendour of the Southern Winter Milky Way, A peak night for the Alpha Capricornid Meteor shower and much more

The overall theme of the weekend will be the Winter Milky Way. The venue is situated at a dark site so this wondrous area of the night sky will be easily visible and riding high in the sky.

The weekend will include:

• Hydrogen-alpha solar viewing and photography

• Interesting talks by both professional and amateur astronomers

• Night-time observing, through a variety of telescopes (feel free to bring your own telescopes – the more the merrier!)

• A telescope trail

The talks, on a wide variety of astronomical topics, will be held throughout the day and, in the event of bad weather, during the evening.

Dates: Friday 29th to 31st July

Venue: Foxton Beach Bible Camp

Fees (applies to all attendees, including day visitors): Over 18 years $23.00, 10-18 years $12, under 10s FREE.

On-site Accommodation: Shared heated Cabins (from twin to 8 per cabin) or Dormitory - $20 per night per person over 10 years old; $3 per night for under 10s.

Note: We will endeavour to accommodate couples and families in cabins ahead of individuals. As the cabins are limited in number, individuals may be asked to use the dormitory accommodation. If you are an individual, and can pre-arrange to share a cabin please tell us beforehand. Any spare cabins will be allocated on a first in, first served basis.

Details: http://www.horoastronomy.org.nz/upcoming-events/stellarfest

Astronomy Films at NZIFF 2016

The New Zealand International Film Festival is screening two films with an astronomical content:

OPERATION AVALANCHE

Let's be honest: we're all a bit over the faux documentary sub-genre. So let's hear it for Canadian Matt Johnson with his devilishly clever cinephile meta-take on the Apollo Moon landing. It's 1967, the height of the cold war, and the CIA suspects a Russian mole is inside NASA sabotaging the programme. Two chipper young agents, disguised as filmmakers capturing NASA's race to the moon, are sent to uncover the mole. They uncover something more shocking than any Russian spy. Suddenly the agents are in way over their heads as they scramble to help save the USA's credibility.

LO AND BEHOLD: REVERIES OF THE CONNECTED WORLD

A fascinating doco by the tirelessly curious Werner Herzog (Fitzcarraldo, Cave of Forgotten Dreams) exploring the evolution of the internet. Starting at the UCLA site where the first internet message was typed, Herzog leads us on a whistle-stop tour, meeting online evangelists and prophets of doom alike. He visits a self-driving car developer; the town of Green Bank, where locals have settled because proximity to a telescope prohibits radio waves and cellular signals; and the home of a family tormented online following the death of a daughter. Elon Musk, a high-priest of digital entrepreneurship, preaches the importance of colonising Mars. 'A one-way ticket?' chirrups Herzog. 'I would come along'.

Dates: Wednesday 27th July to Sunday 7th August.

Details: http://www.nziff.co.nz/2016/wellington/

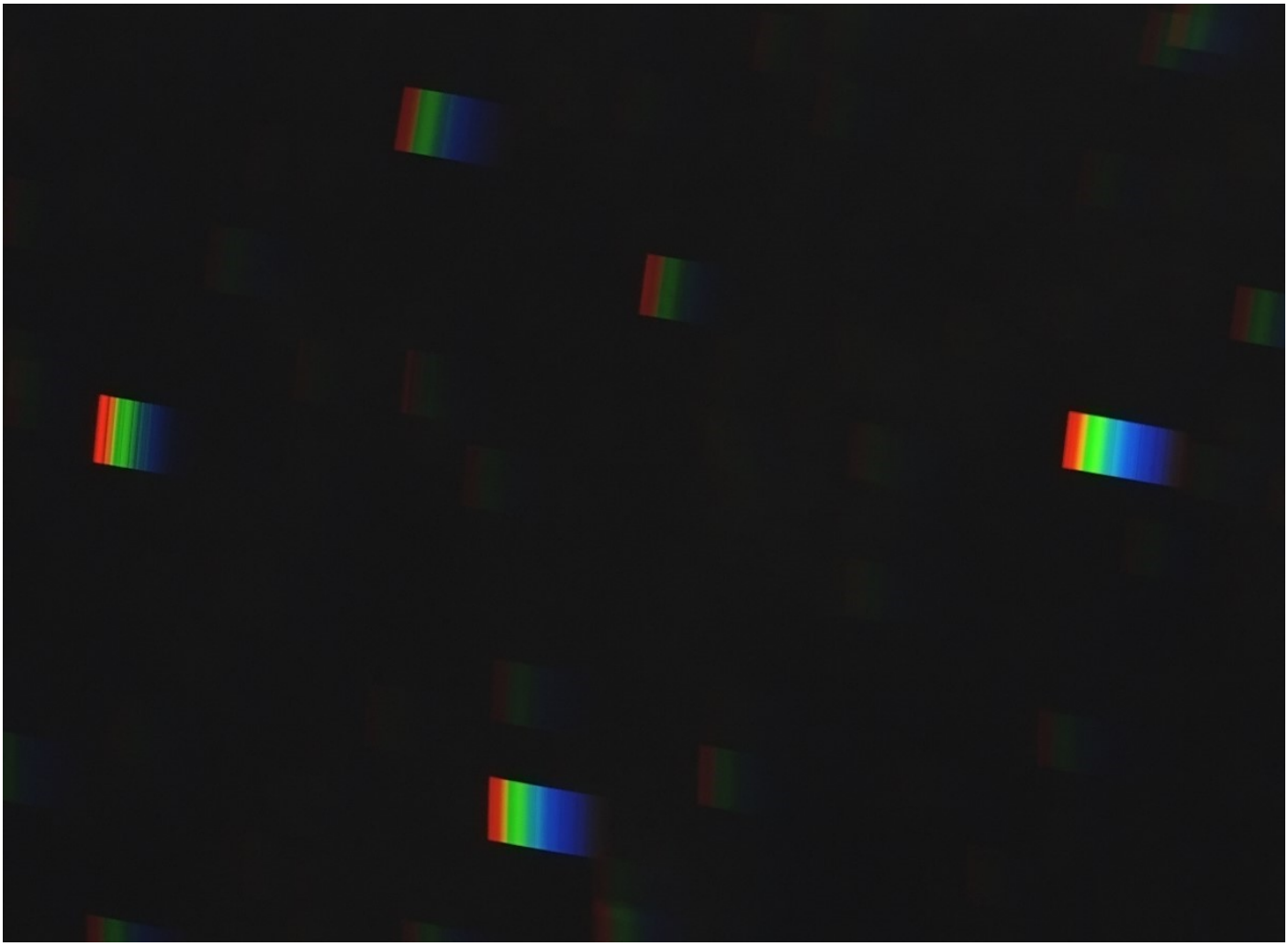
Colour Codes from the Stars - Part 1

There are ample opportunities for Field Astronomers to enjoy the colours from the stars and supply data as contributions to science, especially from the rich southern skies.

Simply looking is fascinating; astronomical spectroscopy is also a major area where more contributors are needed.

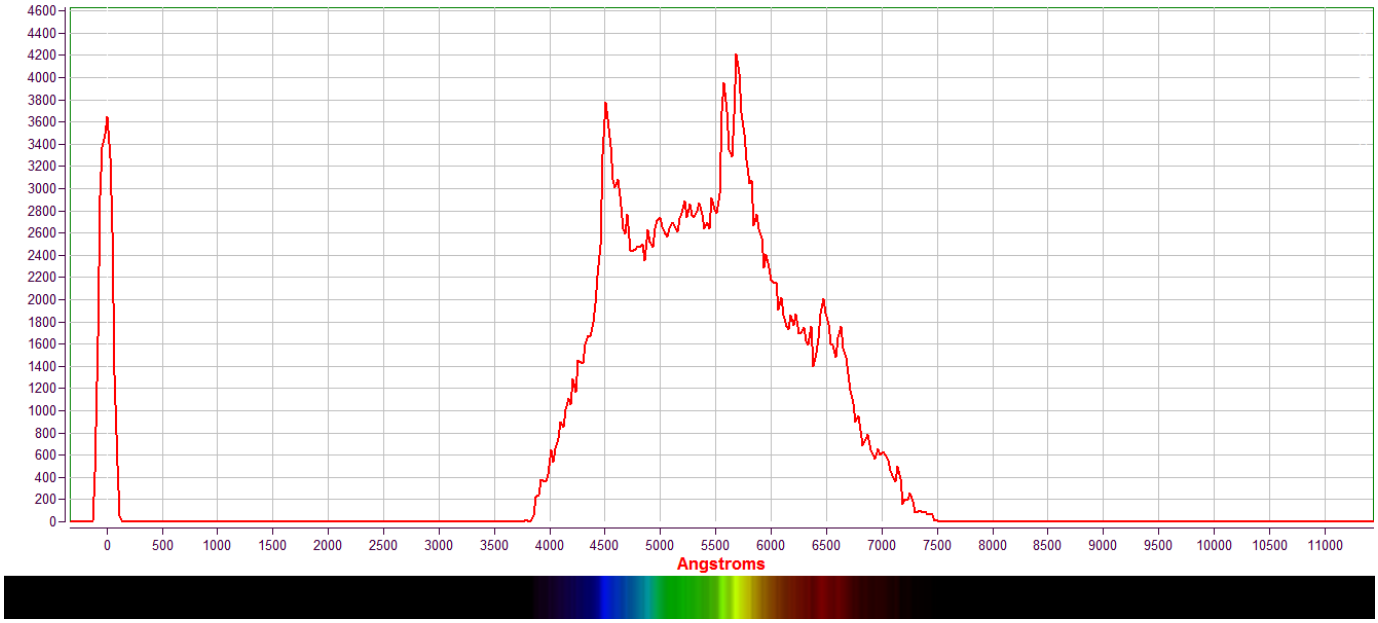
Colour components from the Sun can be seen readily just from any round droplet of water from a blade of grass as vivid, sparkling, bright violet – through other rainbow colours – to deep red. Expanded out we can tell what existed and what was going on dynamically on the Sun. Similarly farther out in deep space too!

A prism or a basic transmission-grating spectroscope (such as the SA100/200, Rainbow Optics) that fits to an eyepiece like a filter, or to a camera or with a CCD can show a beautiful rainbow-like spectrum of each star like this:



Picture 1 Crux Spectra, through an objective prism, 135mm telephoto lens, QHY8 camera. No tracking therefore spreading out each spectrum. Image taken and supplied by Stefan Buda, ASV, Vic.

To see more clearly how strong each colour component, or lack of, is, software (some freeware available) can display data graphically like in the diagram on the following page



Picture 2 Gamma Velorum spectrum. SA100 with a 3.8 degree prism, 9 ¼" Celestron SC, Camera SBIG ST8 and CCDSoft, 1 sec exp., RSpec s/w. Image taken and supplied by Ken McEwen, member SASI, NSW. For illustrative purpose only, with basic wavelength calibration, vertical axis arbitrary intensity scale, horizontal axis wavelength in Angstrom.

Higher resolution equipment (such as L200, Alpy, Lisa, LhiresIII), incorporating a slit reflection-grating and guiding, with careful setup and calibration, can supply data for NASA and Pro-Am campaigns such as BRITE-Constellation, Funnelweb among others.

Find out more from numerous posts and resources on the internet. Follow works by southern hemisphere shining lights in spectroscopy including Bernard Heathcote (Vic), Ken Harrison (Vic), Paul Luckas (WA), Jonathan Powles (ACT), Terry Bohlsen (NSW), Paulo Cacella (Brazil), and Malcolm Locke (NZ).

Please explore and join the fun. Some possibilities are:

Some groups have plastic gratings for making into a hand-held spectroscope; see spectra from lamps and sunlight-glint. Examples of homemade tubes are via the links below.

Ask at group viewings, to see spectra from bright stars such as Sirius, gamma Velorum, eta Carinae. Some members already have equipment. Some Societies (if you ask!) may consider acquiring gratings and, in the future, more advanced equipment, to facilitate observation by members and the public.

Talks and workshops can be organised …. especially if enough interest! Please voice your interest.

A number of people interested to explore spectroscopy, working together as volunteers and not-for-profit, would like all Field Astronomers, whether members of Societies or not, to share the riches of the southern skies and help each other read the colour codes from the stars and other sky objects.

If your Society has distributed the poll information please reply to the address they have advised. Otherwise, to let volunteer organisers know what your interests might be please either go to (preferable) IIS sub-forum Star Parties…. Events: http://www.iceinspace.com.au/forum/showthread.php?p=1254277#post1254277 , or alternatively reply by email to this address: southskyscience at gmail com.

A few among mountains of resources:

Intro to Stellar Spectra https://youtu.be/jjmjEDYqbCk
Colours, Life and Death of Stars: https://youtu.be/HdBzVW1r9K4

http://publiclab.org/wiki/foldable-spec
http://publiclab.org/wiki/smartphone-spectrometer

IIS http://www.iceinspace.com.au/forum/forumdisplay.php?f=40
ARAS Spectroscopy Forum http://spectro-aras.com/forum/
Astronomical Spectroscopy for Amateurs https://groups.yahoo.com/neo/groups/astronomical_spectroscopy/info
Christian Buil website www.astrosurf.com/buil/

by Team at Southskyscience
A version of this article has been submitted for newsletters of Astronomy Societies in Australia and New Zealand

Hubble's bubble lights up the interstellar rubble

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!

Image credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA), of the Bubble Nebula as imaged 229 years after its discovery by William Herschel.

When isolated stars like our Sun reach the end of their lives, they're expected to blow off their outer layers in a roughly spherical configuration: a planetary nebula. But the most spectacular bubbles don't come from gas-and-plasma getting expelled into otherwise empty space, but from young, hot stars whose radiation pushes against the gaseous nebulae in which they were born.

While most of our Sun's energy is found in the visible part of the spectrum, more massive stars burn at hotter temperatures, producing more ionizing, ultraviolet light, and also at higher luminosities. A star some 40-45 times the mass of the Sun, for example, might emits energy at a rate hundreds of thousands of times as great as our own star.

The Bubble Nebula, discovered in 1787 by William Herschel, is perhaps the classic example of this phenomenon. At a distance of 7,100 light years away in the constellation of Cassiopeia, a molecular gas cloud is actively forming stars, including the massive O-class star BD+60 2522, which itself is a magnitude +8.7 star despite its great distance and its presence in a dusty region of

space. Shining with a temperature of 37,500 K and a luminosity nearly 400,000 times that of our Sun, it ionizes and evaporates off all the molecular material within a sphere 7 light years in diameter. The bubble structure itself, when viewed from a dark sky location, can be seen through an amateur telescope with an aperture as small as 8" (20 cm).

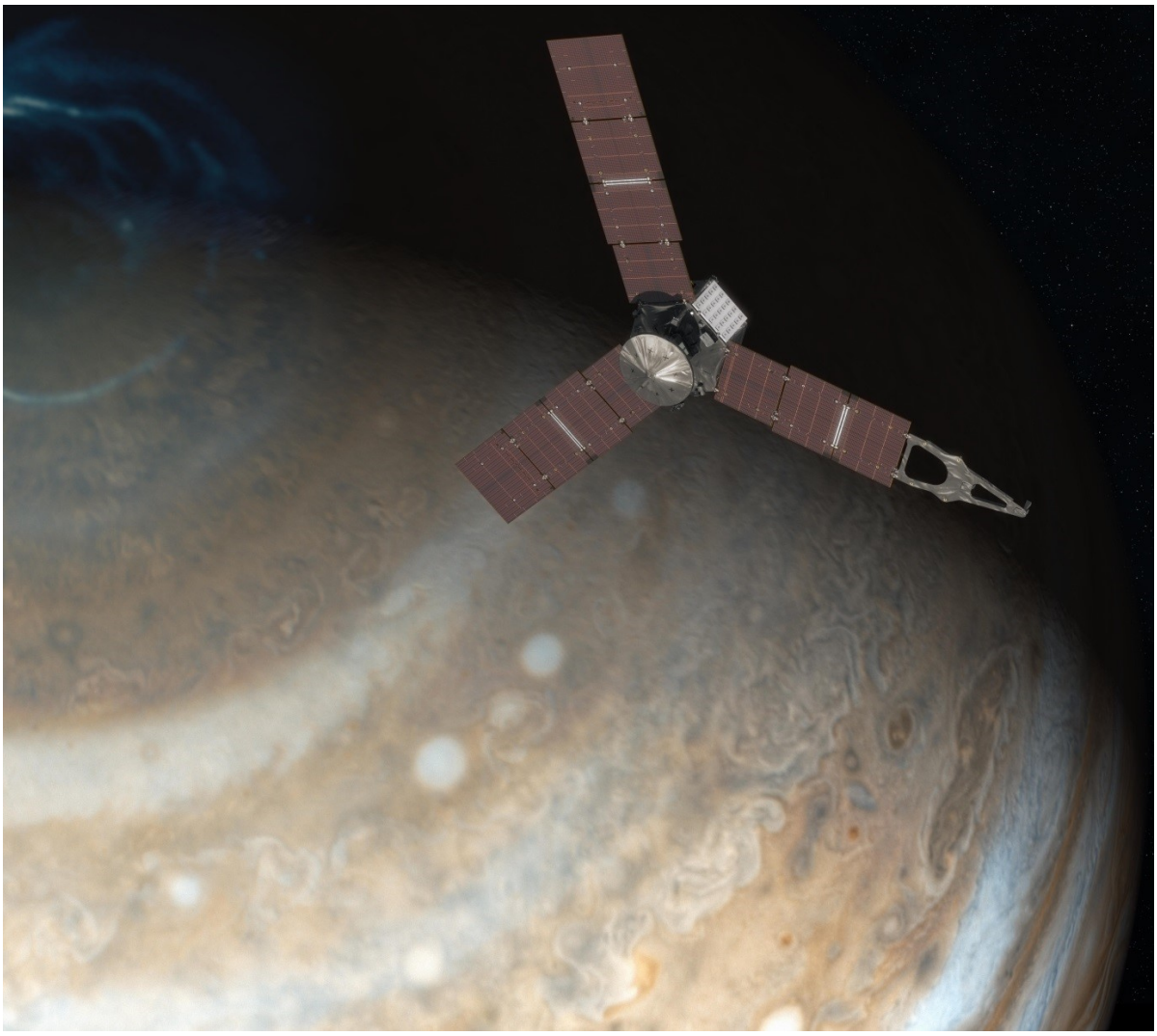
As viewed by Hubble, the thickness of the bubble wall is both apparent and spectacular. A star as massive as the one creating this bubble emits stellar winds at approximately 1700 km/s, or 0.6% the speed of light. As those winds slam into the material in the interstellar medium, they push it outwards. The bubble itself appears off-center from the star due to the asymmetry of the surrounding interstellar medium with a greater density of cold gas on the "short" side than on the longer one.

The blue color is due to the emission from partially ionized oxygen atoms, while the cooler yellow color highlights the dual presence of hydrogen (red) and nitrogen (green).

The star itself at the core of the nebula is currently fusing helium at its center. It is expected to live only another 10 million years or so before dying in a spectacular Type II supernova explosion.

Ethan Siegel

NASA's Juno Spacecraft Arrives at Jupiter



On the 24th June, at exactly 4:57 and 48 seconds a.m. NZST, NASA's Juno spacecraft was 8.9 million kilometers (5.5 million miles) from its July 4th appointment with Jupiter. Over the past two weeks, several milestones occurred that were key to a successful 35-minute burn of its rocket motor, which will place the robotic explorer into a polar orbit around the gas giant.

"We have over five years of spaceflight experience and only 10 days to Jupiter orbit insertion," said Rick Nybakken, Juno project manager from NASA's Jet Propulsion Laboratory in Pasadena, California. "It is a great feeling to put all the interplanetary space in the rearview mirror and have the biggest planet in the solar system in our windshield."

On June 11, Juno began transmitting to and receiving data from Earth around the clock. This constant contact will keep the mission team informed on any developments with their spacecraft within tens of minutes of it occurring. On June 20, the protective cover that shields Juno's main engine from micrometeorites and interstellar dust was opened, and the software program that will command the spacecraft through the all-important rocket burn was uplinked.

One of the important near-term events remaining on Juno's pre-burn itinerary is the pressurization of its propulsion system on June 28. The following day, all instrumentation not geared toward the successful insertion of Juno into orbit around Jupiter on July 4 will be turned off.

"If it doesn't help us get into orbit, it is shut down," said Scott Bolton, Juno's principal investigator from the Southwest Research Institute in San Antonio. "That is how critical this rocket burn is. And while we will not be getting images as we make our final approach to the planet, we have some interesting pictures of what Jupiter and its moons look like from five-plus million miles away."

The mission optical camera, JunoCam, imaged Jupiter on June 21, 2016, at a distance of 10.9 million kilometers (6.8 million miles) from the gas giant. In the image, just to the right of center is Jupiter, with its distinctive swirling bands of orange, brown and white. To the left of Jupiter (from right to left) are the planet's four largest moons -- Europa, Io, Callisto and Ganymede. Juno is approaching over Jupiter's north pole, affording the spacecraft a unique perspective on the Jovian system. Previous missions that imaged Jupiter on approach saw the system from much lower latitudes, closer to the planet's equator.

JunoCam is an outreach instrument -- its inclusion in this mission of exploration was to allow the public to come along for the ride with Juno. JunoCam's optics were designed to acquire high-resolution views of Jupiter's poles while the spacecraft is flying much closer to the planet. Juno will be getting closer to the cloud tops of the planet than any mission before it, and the image resolution of the massive gas giant will be the best ever taken by a spacecraft.

All of Juno's instruments, including JunoCam, are scheduled to be turned back on approximately two days after achieving orbit. JunoCam images are expected to be returned from the spacecraft for processing and release to the public starting in late August or early September.

"This image is the start of something great," said Bolton. "In the future we will see Jupiter's polar auroras from a new perspective. We will see details in rolling bands of orange and white clouds like never before, and even the Great Red Spot.

The Juno spacecraft launched on Aug. 5, 2011, from Cape Canaveral, Florida.

JPL manages the Juno mission for the principal investigator, Scott Bolton, of Southwest Research Institute in San Antonio. Juno is part of NASA's New Frontiers Program, which is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama, for NASA's Science Mission Directorate. Lockheed Martin Space Systems, Denver, built the spacecraft. The California Institute of Technology in Pasadena, California, manages JPL for NASA.

More information on the Juno mission is available at: http://www.nasa.gov.

Antony Gomez, based on material from the NASA web-site.

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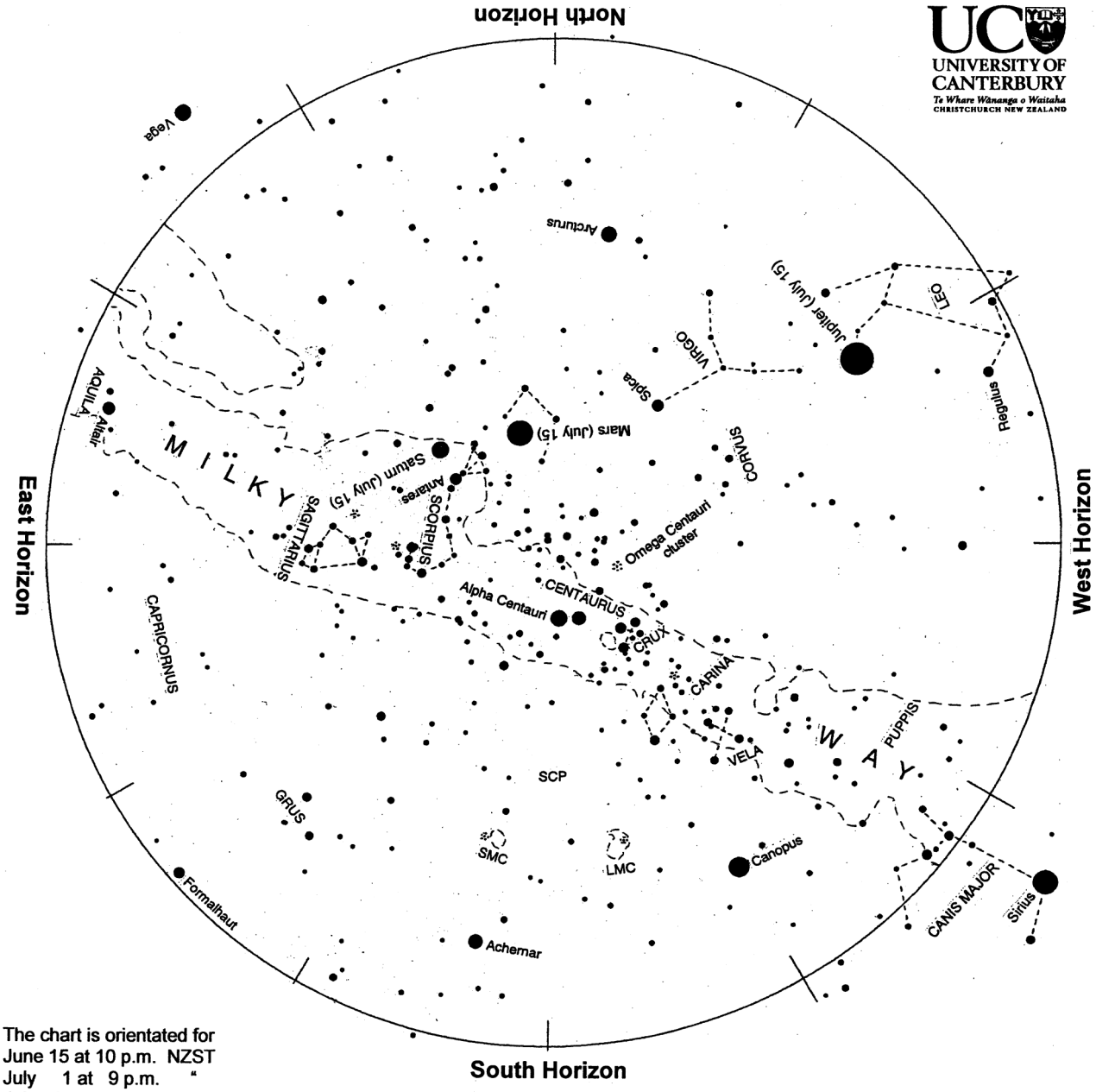

The chart is orientated for
June 15 at 10 p.m. NZST
July 1 at 9 p.m. "
July 15 at 8 p.m. "
Aug. 1 at 7 p.m. "

Evening sky in July 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.

Soon after sunset golden Jupiter and orange Mars appear in the north and east, respectively. Sirius, the brightest true star, sets in the southwestern twilight, sparkling colourfully. Saturn is below Mars with orange Antares above. Low in the north is orange Arcturus, the same brightness as Saturn. The Pointers and Crux, the Southern Cross, are south of the zenith. Canopus, the second brightest star, is low in the southwest. It swings down to the southern horizon later. Vega rises in the northeast around 9 p.m. Brilliant Venus and fainter Mercury (not shown) move higher in the western twilight through the month.

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 July

Bright planets and bright stars are scattered over the evening sky. Golden Jupiter appears in the north soon after sunset and orange Mars in the northeast. Cream-coloured Saturn appears below and right of Mars as the sky darkens. Sirius, the brightest true star, sets in the southwest as twilight ends, twinkling like a diamond. Canopus, the second brightest star, is also in the southwest at dusk. It swings south later. Midway down the north sky is orange Arcturus, similar in brightness to Saturn. South of the zenith are 'The Pointers', Beta and Alpha Centauri. They point to Crux the Southern Cross on their right. Vega rises in the northeast around 9 pm.

Brilliant Venus (not shown) sets in the west about 25 minutes after the Sun at the beginning of the month so might be seen from places with a low western skyline. Its setting time gets steadily later. By the end of the month it sets more than an hour after the sun. Mercury (not shown) joins Venus in the first half of July. On the 17th the two planets will appear close together. Mercury will be much fainter than Venus. The apparent pairing is just a line-of-sight effect. Mercury is 194 million km from us, coming around from the far side of the Sun. Venus is 253 million km away on the far side of the sun. For the rest of the month Mercury will be above and right of Venus. On the 30th-31st Mercury will be passing Regulus, the brightest star in Leo. So all five naked-eye planets will be in the early evening sky in the second half of July.

Jupiter and Saturn are always worth a look in any telescope. Jupiter's four 'Galilean' moons can be seen lined up on each side of the planet. Sometimes one or two may be missing as they pass in front of, or behind, Jupiter. The Moon will be near Jupiter on the 9th. A small telescope shows Saturn's ring system and biggest moon Titan looking like a star about four ring-diameters from the planet. Big telescopes show fainter moons closer in. Jupiter is 890 million km away mid-month; Saturn is 1390 million km away. Mercury, Venus and Mars, though bright, are small in a telescope. Mars is 95 million km away mid-month and fading as we leave it behind.

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Alpha Centauri is the third brightest star. It is also the closest of the naked eye stars, 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 swings down to the southern skyline before midnight then moves into the southeast sky in the morning hours. It is a 'circumpolar star': it never sets. Crux and the Pointers are also circumpolar. Canopus is a truly bright star: 13 000 times the sun's brightness and 300 light years away.

Arcturus, in the north, is the fourth brightest star and the brightest in the northern hemisphere sky. It is 120 times the sun's brightness and 37 light years away. It twinkles red and green when setting in the northwest around midnight. It is an orange colour because it is cooler than the sun; around 4000°C.

East of the zenith, above Saturn, is the orange star Antares, marking the heart of the Scorpion. The Scorpion's tail, upside down, is stretched out to the right of Antares making 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. Below Scorpius is 'the teapot' made by the brightest stars of Sagittarius. It is also upside down in our southern hemisphere view.

The Milky Way is brightest and broadest in the east toward Scorpius and Sagittarius. In a dark sky it can be traced up past the Pointers and Crux, fading toward Sirius. 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. The actual centre is hidden by dust clouds in space. A scan along the Milky Way with binoculars shows many clusters of stars and some glowing gas clouds.

The Large and Small Clouds of Magellan, LMC and SMC, look like two misty patches of light low in the southern sky. They are easily seen by eye on a dark moonless night. They are galaxies like our Milky Way, but much smaller. The Large Cloud is 160 000 light years away and 5% of the mass of the Milky Way. The Small Cloud is 200 000 light years and 3% of the Milky Way's mass.

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

www.canterbury.ac.nz