Shoalhaven Astronomers Inc.
www.shoalhavenastronomers.asn.au

Volume 19
Issue 6

Astro Flyer

JUNE 2019

Club News

Hello All,

I had a fascinating time along with many others in the club when the Atkin's household (Martin and Robbie) opened their home and three very large telescopes to us. It was well worth the trip because I saw things through those telescopes I had never seen in such detail before through a private telescope. The **Eta Carina** area and the **Tarantula Nebula** in the LCM were standout views. Robbie offered hot soup which was greatly welcomed by all and sundry. A big thank you goes out to the Atkins!

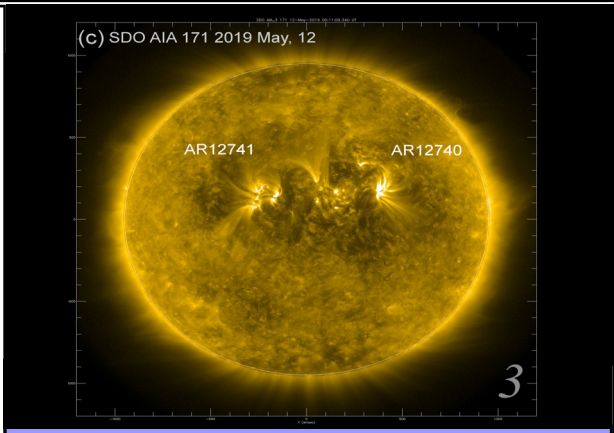
The month of July (July 19th) brings the yearly Annual General Meeting. If you would like to hold an office or become a member of the Committee the AGM is the place to do it. Forms will be available at the June meeting. Also the yearly subscriptions to the club become due.

The June 21st meeting will have Harry Roberts give a talk on the Carina region and some recent Sun events. New member John Bambury will give a talk on "Southern Sky Gems", and of course, I will present a few multimedia astronomical selections on the big screen.
See you at the June 21st meeting.

Frank Gross, President, Shoalhaven Astronomers, Inc.

Next monthly meeting will be held at the Shoalhaven Campus of the Uni of W'Gong, George Evans Road off Yawal Road, West Nowra, June 21st, 6.30 pm for 7pm start.

Contents



MOON PHASES

New Moon	First Quarter	Full Moon	Last Quarter
July 3	July 9	June 17	June 25

Viewing Nights

Club viewing nights are selected to provide viewers with the best possible conditions for good viewing. They are held on specific Saturdays at different locations around Nowra.

The next club viewing night will be on Saturday 22 June (back-up night Sun 23 June) at Woncur Rd South Nowra (Head South down The Princes Highway, turn right at BTU Road, Woncur Road is the street first on the left).

More Club Information Page 17

OUT THERE
Bob Turnbull OBSERVATION OFFICER

JUNE-JULY 2019

Now are the clear days and nights which are ideal for viewing, so I look forward to some interesting feedback about what you club members are actually viewing – Sky wise !
I hope you have seen plenty to study in the night sky and caught some of the program for viewing in last month's "OUT THERE".

Telescopes: These need to be acclimatised by setting up about 30 minutes before viewing so reducing fogging of mirrors and eye pieces!

PLANETS

JUPITER Should be the biggest and best of the planets, coming to opposition on the 11th of June at -2.6 magnitude, then dropping to 2.5 magnitude in July. It is bright in the Eastern morning sky in Ophiuchus and on the 16th it is near (to our eye) to the Full Moon in a triangle with Antares, in Scorpio.
So at 46 arcminutes it is easy to see with almost any sized telescope and the bigger the telescope the better the detail (provided you look after the Moon is waning) So refer to page 120 for rising times, and satellites at EST, with visible events. For those "sleepy heads" viewing, like me, the evening viewing around 19:43 EST is more rewarding and comfortable from the 1st of June.

SATURN This major planet (to our eyes) rises in the East at 7pm mid month, in June and exhibits its amazing ring system, at 24 degrees, plenty to see with this planet as a favourite to most members, so see page 125 in Astronomy 2019 for future viewing times.

VENUS Blasts into the dawn sky in the East and on the 2nd of June it will be 3 degrees north of a sliver waning Moon. You will not see this planet until September.

METEOR SHOWERS

The theta-Ophiuchids, were seen in 2010 and listed in 2011 and they could be very interesting bright and slow with long trains and the best reached -5 magnitude with a 30 degree train. So watch for these on the 21st of May until June the 16th, with a peak around the 10th and 11th, best seen after midnight.

Clear skies and good viewing!
BOB TURNBULL

VIEWING NIGHTS

Club/Social Viewing Nights are on Saturday evenings "just" Before Sunset. Viewing nights are for members and invited guests. The contingency plan for poor weather on the proposed viewing night is to meet the next night (a Sunday night) .

Woncur Road, South Nowra (Head South down The Princes Highway, turn right at BTU Road, Woncur Road is the street first on the left).

University Viewing site. On the way to the university on George Evans Road go straight ahead through the second turning circle to the new viewing site.

SHOALHAVEN ASTRONOMERS SUGGESTED VIEWING NIGHTS

JUNE to DECEMBER 2019

JUNE 22nd or 23rd	WONCUR ROAD	6 PM TO 8 PM
JULY 27th	NOWRA UNIVERSITY CAMPUS	6 PM TO 8 PM
AUGUST 10th	WONCUR ROAD	6 PM TO 8 PM
SEPTEMBER 21st	NOWRA UNIVERSITY CAMPUS	6 PM TO 8 PM
OCTOBER 5th	MEMBERS HOME CHOICE	6 30 PM TO 8:30 PM
NOVEMBER 2nd	WONCUR ROAD	6 45 PM TO 9:00 PM
DECEMBER	TO BE ARRANGED AS REQUIRED (OPTIONAL)	

Bring your scopes and or binoculars and a small folding chair, a decision on the day planned, depending on viewing conditions, by the club president and his deputy.

Email information if details are changed, to all, or contact Frank for changes.

Solar viewing BBQ lunches (BYO) may be held and these will be advised ahead of these events. Special events such as Comets, eclipses etc. may also warrant members night viewings.

Bob Turnbull
OBSERVATION OFFICER

The Visual Astronomer
Part 7

Eugene O'Connor

Weather challenges of the Astronomer

As I read over my notes from the past twenty years I am struck by the varied weather conditions the visual astronomer faces. We not only have to battle the clouds and the wind and extreme temperatures, but the fact that in a viewing evening we face constant changes in seeing conditions. Sometimes for example when we have three clear nights in the row that appear the same and where the heavens are filled with stars, we can see Alpha Centauri as a pulsating snowball, a dull clear pinpoint of light surrounded by faint haze or - much more rarely- a sharp clear double star. I have also noticed that a clear sky at sunset is not always a sign of a clear viewing evening, but the clouds that roll in can dissipate and leave a brilliant sky by 10 pm. At lease in wintertime when we have a longer window of opportunity our chances of a clear hour are better. But not always, as the following dip into my journals from June 2001 reveals:

Awash in Centauri!

Two nights ago, I took some visiting friends on their first tour of the night skies. My back lawn displayed the full armory of a two-inch refractor, the 25X100 binoculars, the 8" and the 16" Dob, a step ladder, deck chairs and several 7X50 binoculars. The Moon had a mild, four-day-old presence.

These friends wanted the general tour of the full range of best objects.! Having put the Moon, the Solar System and our Galaxy into perspective, I gradually got their eyes adjusted to the dark and showed them where the eyepiece was found on all machines. Mars was behaving badly with little to be seen and the Moon was a favorite until I unleashed Omega Centauri in the 16." I then moved through the striking doubles of Alpha Centauri and Gamma Velorum and then the Jewel box. They were riveted to machines at this point, so I sat on a deck chair and chuckled at the comments. The Sombrero was next, followed by Centaurus A. By this time the wind was coming up making the eight-inch wobble and we decided that hot drinks and fruit cake should end the night.

Cont...2

The Jewel Box is located just south of Beta Crux

They departed at ten and by this time both the Moon and the wind had disappeared, so I decided to catch up on Centaur's unusual doubles. I was to learn a very important lesson in the coming hours.
Instrument: 8" Newt. F9, eyepieces: 25mm K, 12.5 mm Ortho. Seeing:8 Transparency 8/10.. Unless otherwise stated, all observations are made at X72.

1)Lambda 180 Cent: On my homespun chart this carries the designation SEE 180 and it sits about a degree east of Centaurus A, the Hamburger Galaxy. At this hour it sat at a comfortable angle on my South West horizon.
Comments: This double floats in a rich field of stars. The 6.5 primary appears Bluish/white and the wide(3.7") companion has a deep Rose colour . Another bright star is seen in the field at low power.

2) Beta 1112 Cent: This double is located near a rich cluster of doubles that form the group 1,2,3 and 4 Cent which are now less than 45 degrees off the Western horizon and very convenient in a dobsonian.
Comments: This is a well separated (2.5") and contrasting double of mag. 6/9.5. It took me some moments to detect the faint companion which emerged with averted vision after thirty seconds. Another widely separated double is found in the field.

3) Fin 351. This is one of a naked-eye double in the region of Omega Centauri. Sky Catalogue list this double as 7.2/7.2 mag. sep. 0.1"(1960) I found afterwards. However bizarre this sounds, I split this star at X144 and found both stars Light Blue. Several wide and faint doubles enhance a rich field .

4) Howe 94. Kepple and Sanner list this as a 6.6 and 9.6 wide 11.6" in the area of 2 cent.
It turned out to be a Whitish/ Yellow primary with the wide companion a pinkish tint. A very rich field.

5) Rmk 18 This is another double listed by Kepple and Sanner, who call them a white pair. I found these 5.4/7.6 mag. stars, at sep. 18", a delightful rich Blue and Bluish Violet shade with faint outliers in a dark field. A stunning field at low power.

Ambience: The wind had returned and so convinced was I that the five dry day forecast was accurate I left the 8" and 16" under minimum wraps in my back yard.

I was just adjusting my electric blanket when I suddenly heard a drumming sound. I sat for a second stunned. 'Is that rain?' quizzed my ultra-observant wife over her spectacles from her snug blankets. I bounded out, swearing forked lightning at meteorologists everywhere and turned on all back lights. Already pools of water sloshed around both telescopes. The 8" was the more exposed and I shoved a dolly under it and had it in the shed in seconds. The precious 16" took some time. I had to slide separate poles containing buggy wheels through slots on the side of the rocker box and then across the lawn and up a make-ship ramp into a raised shed.
One wheel ran off the ramp, dumping all the weight on the other wheel assembly which buckled and broke off! The telescope sat stuck like a listing and recalcitrant baby elephant. Under heavy rain and soaked to the skin I slowly removed all optics, now well washed and left the bogged machine to its fate. By the time I had dried off and changed, the sky was clear. I will never forget that first image of the soaking back lawn where an hour earlier dry doubles feasted the eyes. Never trust the forecast. Always pack up!

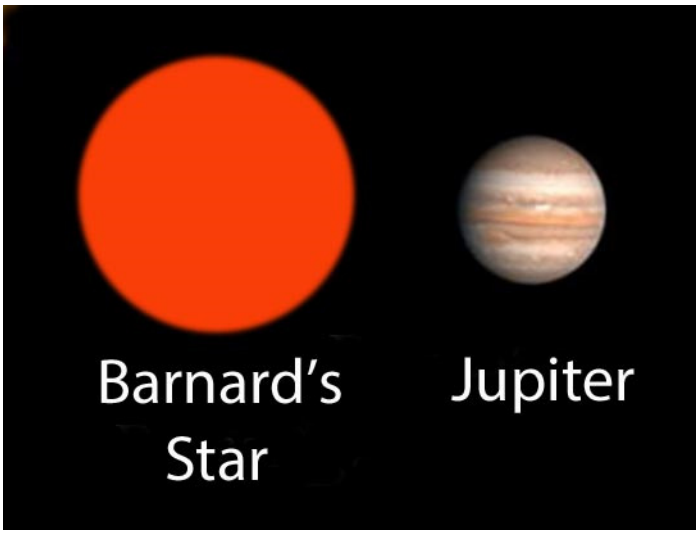
Sky Objects By Eugene O'Connor

Cont...3

Astro Events from Frank Gross

Astronomers Have Discovered A "Super-Earth" Really Close To Earth

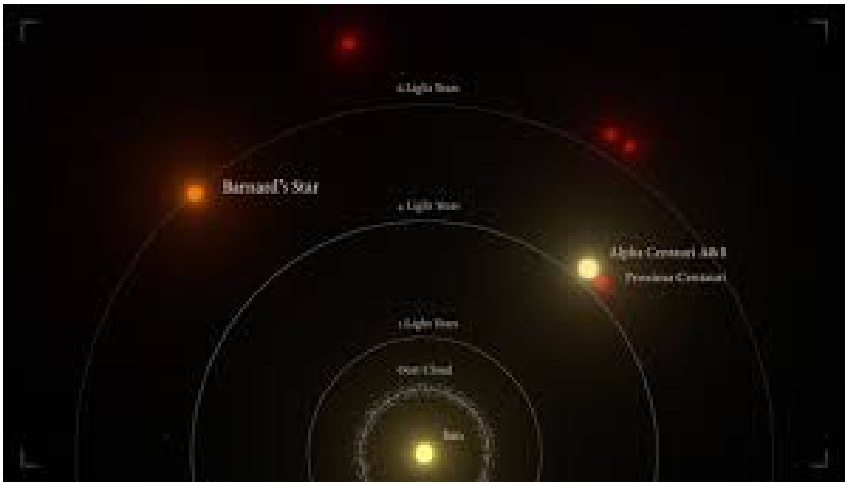
For most of human history, people wondered if there were other planets out there in the unfathomable reaches of space. It turns out there are some very close to Earth, though. A team of astronomers has revived interest in Barnard's Star, which hangs in space just six light years away.



After dismissing evidence for an exoplanet orbiting this star in the 1970s, the team now says there's a very good chance Barnard's Star does indeed host a super-Earth. Barnard's Star is a red dwarf and one of the closest stars to Earth. Only the Centauri system is closer, and we know there's at least one exoplanet there. Astronomers announced the discovery of Proxima Centauri b with great fanfare in 2016.

At just 4.4 light years away, this planet will make an excellent target for future observation. The planet orbiting Barnard's Star is just a little bit more distant, but it's still close enough to be key to understanding exoplanets. The tale of planet hunting around Barnard's Star starts in the 1960s when astronomer Peter van de Kemp released compelling data supporting the existence of an exoplanet.

The newly detected planet, Barnard's Star b, is thought to be rocky and at least 3.2 times more massive than the Earth. It circles a cool red-dwarf star, smaller and older than the sun, completing one orbit every 233 days
However, other teams were unable to confirm, and by the 1970s we knew the discovery was merely a product of defective instruments. Scientists kept looking at the star, and now astronomers from the Institute of Space Studies of Catalonia and the Institute of Space Sciences in Spain have assembled 20 years of data to reveal Barnard's Star b. The newly published study lays out the basics of the exoplanet.



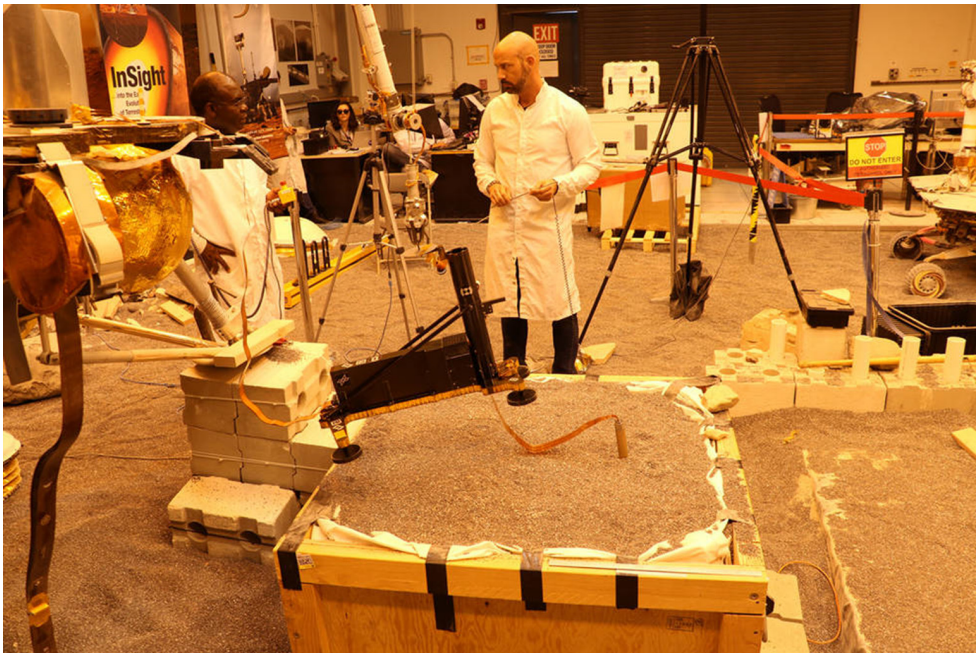
Barnard's Star b completes an orbit of the star every 233 Earth days. It's about as far away from Barnard's Star as Mercury is from Earth, but Barnard's Star is much cooler. So, it's distinctly outside the habitable zone with a surface temperature of -170 degrees Celsius (-274 degrees Fahrenheit). It's the equivalent of a planet orbiting between Mars and Jupiter in our solar system.

Barnard's Star is six light years from Earth - hardly any distance on astronomical scales - a dim dwarf with a luminosity 0.0035 times that of the sun. The only closer star system is Alpha Centauri 4.4 light years away.

Cont...2
Barnard's Star b has a mass about three times that of Earth, but we don't know its size or composition yet. We suspect it's rocky, though. Barnard's Star b does not transit in front of its host star from Earth's perspective — that would have made detection vastly simpler. Instead, the team used the radial velocity method. They watched for small counter movements in the star that indicate a massive body (a planet) is in orbit.

A smaller star like Barnard's Star wobbles more than a more massive one, so even a small-ish planet like this one had some detectable effect. The team claims high confidence that Barnard's Star b is real, but other teams will need to confirm. We don't want another van de Kemp scenario.

InSight's Team Tries New Strategy to Help the 'Mole'



Engineers in a Mars-like test area at NASA's Jet Propulsion Laboratory try possible strategies to aid the Heat Flow and Physical Properties Package (HP3) on NASA's InSight lander, using engineering models of the lander, robotic arm and instrument.
Credits: NASA/JPL-Caltech
Full image and caption

Scientists and engineers have a new plan for getting NASA InSight's heat probe, also known as the "mole," digging again on Mars. Part of an instrument called the Heat Flow and Physical Properties Package (HP^3), the mole is a self-hammering spike designed to dig as much as 16 feet (5 meters) below the surface and record temperature.

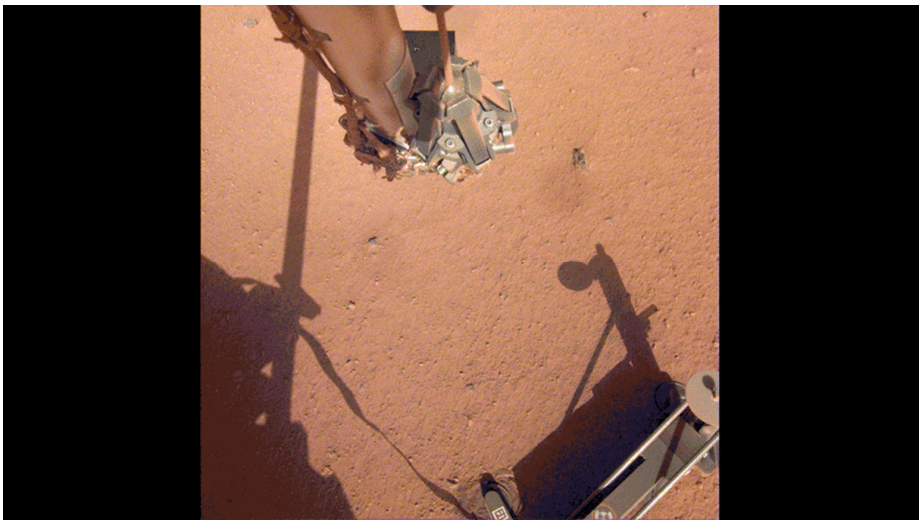
But the mole hasn't been able to dig deeper than about 12 inches (30 centimeters) below the Martian surface since Feb. 28, 2019. The device's support structure blocks the lander's cameras from viewing the mole, so the team plans to use InSight's robotic arm to lift the structure out of the way. Depending on what they see, the team might use InSight's robotic arm to help the mole further later this summer.

Astro Events from Frank Gross

Cont...3

HP^3 is one of InSight's several experiments, all of which are designed to give scientists their first look at the deep interior of the Red Planet. InSight also includes a seismometer that recently recorded its first marsquake on April 6, 2019, followed by its largest seismic signal to date at 7:23 p.m. PDT (10:23 EDT) on May 22, 2019 - what is believed to be a marsquake of magnitude 3.0.

For the last several months, testing and analysis have been conducted at NASA's Jet Propulsion Laboratory in Pasadena, California, which leads the InSight mission, and the German Aerospace Center (DLR), which provided HP^3, to understand what is preventing the mole from digging. Team members now believe the most likely cause is an unexpected lack of friction in the soil around InSight - something very different from soil seen on other parts of Mars. The mole is designed so that loose soil flows around it, adding friction that works against its recoil, allowing it to dig. Without enough friction, it will bounce in place.



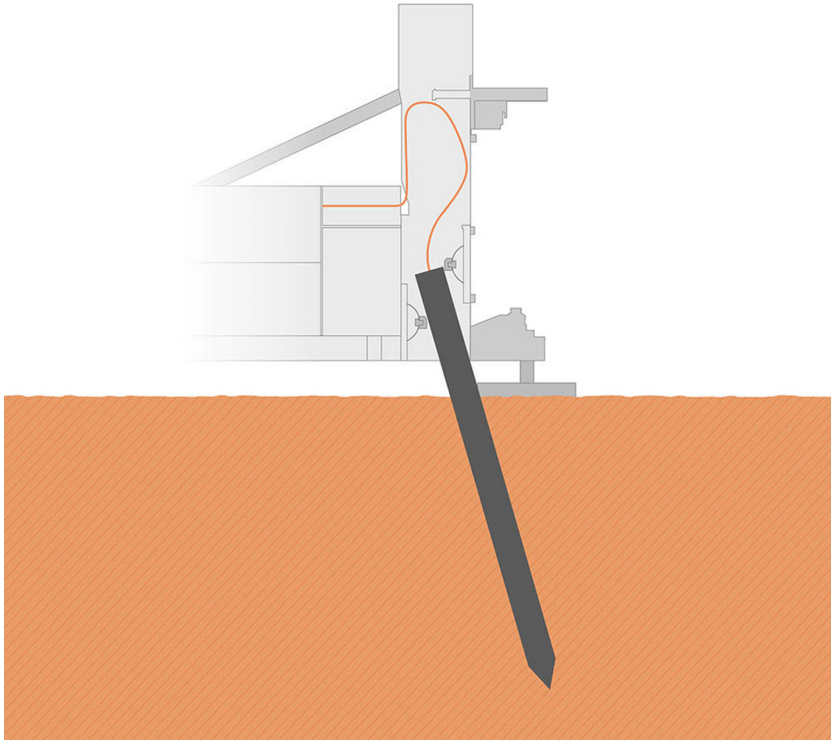
The robotic arm on NASA's Mars InSight lander moves in place over the Heat Flow and Physical Properties Package (HP3) and opens the fingers of its grapple in this series of images from June 1, 2019.
Credits: NASA/JPL-Caltech

"Engineers at JPL and DLR have been working hard to assess the problem," said Lori Glaze, director of NASA's Planetary Science Division. "Moving the support structure will help them gather more information and try at least one possible solution."

The lifting sequence will begin in late June, with the arm grasping the support structure (InSight conducted some test movements recently). Over the course of a week, the arm will lift the structure in three steps, taking images and returning them so that engineers can make sure the mole isn't being pulled out of the ground while the structure is moved. If removed from the soil, the mole can't go back in.

The procedure is not without risk. However, mission managers have determined that these next steps are necessary to get the instrument working again.

Cont...4

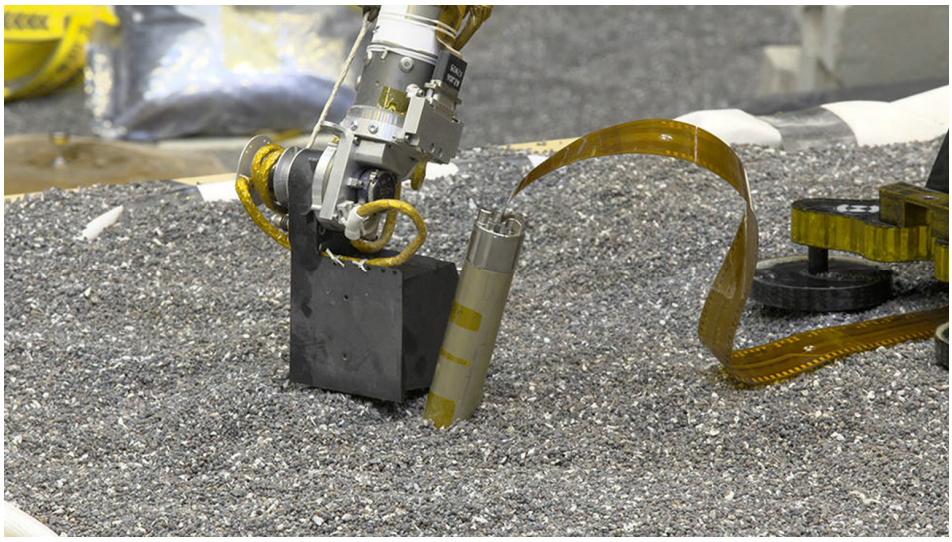


The self-hammering mole, part of the Heat Flow and Physical Properties Package (HP3) on NASA's InSight lander, was only partially buried in the soil of Mars as of early June 2019, as shown in this illustration.
Credits: NASA/JPL-Caltech/DLR
Full image and caption

"Moving the support structure will give the team a better idea of what's happening. But it could also let us test a possible solution," said HP^3 Principal Investigator Tilman Spohn of DLR. "We plan to use InSight's robotic arm to press on the ground. Our calculations have shown this should add friction to the soil near the mole."

A Q & A with team members about the mole and the effort to save it is at:

https://mars.nasa.gov/news/8444/common-questions-about-insights-mole/?site=insight



In a JPL lab, a replica of NASA InSight's robotic arm presses with its scoop on crushed garnet near a replica of the spacecraft's self-hammering "mole." Engineers believe pressing like this on Martian soil may help the mole dig by increasing friction of the surrounding soil.
Credits: NASA/JPL-Caltech
Full image and caption

JPL manages InSight for NASA's Science Mission Directorate. InSight is part of NASA's Discovery Program, managed by the agency's Marshall Space Flight Center in Huntsville, Alabama. Lockheed Martin Space in Denver built the InSight spacecraft, including its cruise stage and lander, and supports spacecraft operations for the mission.

Cont...5

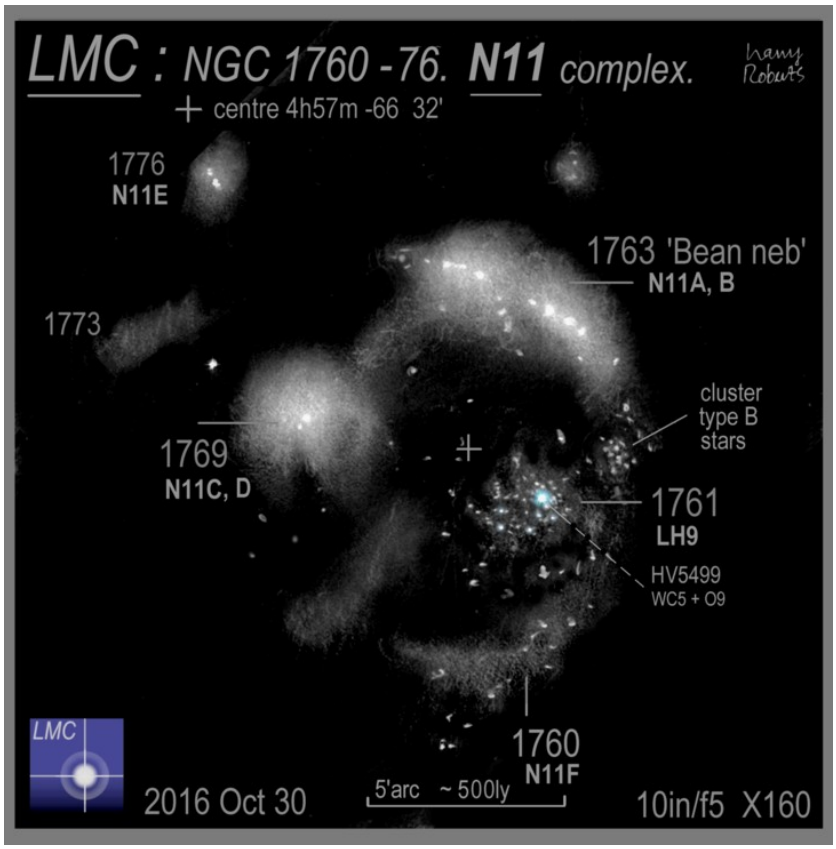
A number of European partners, including France's Centre National d'Études Spatiales (CNES) and the German Aerospace Center (DLR), are supporting the InSight mission. CNES provided the Seismic Experiment for Interior Structure (SEIS) instrument to NASA, with the principal investigator at IPGP (Institut de Physique du Globe de Paris). Significant contributions for SEIS came from IPGP; the Max Planck Institute for Solar System Research (MPS) in Germany; the Swiss Federal Institute of Technology (ETH Zurich) in Switzerland; Imperial College London and Oxford University in the United Kingdom; and JPL. DLR provided the Heat Flow and Physical Properties Package (HP^3) instrument, with significant contributions from the Space Research Center (CBK) of the Polish Academy of Sciences and Astronika in Poland. Spain's Centro de Astrobiología (CAB) supplied the temperature and wind sensors.

Large Magellanic Cloud by Harry Roberts

The LMC: 'A Mud Map' 2

In 'Mud Map' 1 we noted that LMC objects rarely have common names, but can have many non-consecutive NGC numbers! It's a problem for all who would explore the Cloud. Here simple names for the major features are proposed; most are already in use.

In 'Mud Map' 1 we noted the Cloud's big central 'Bar', the 'Tarantula Nebula' and a remarkable 'Super-Bubble' Complex already dubbed 'N11' (Fig). The 'N' indicates a nebula from Henize's 1956 Catalog (not the NGC). It comprises multiple nebulae, clusters and 'super stars': it is an incredible 'Super-Bubble' object, subject of many science papers over recent years. Six of its main parts are named N11A to N11F. On our Mud Map it's N11.



N11 : in journals it is described as: "the second largest nebula of the LMC, (it) is formed of a large bubble surrounded by 9 bright nebulae and filaments".
"...star formation is triggered at the shock boundaries of the nebula excited by an OB association in a time scale shorter than previously found... (is) evidence for a new class of giant bubble, designated as "ring of HII regions bubble" with distinctive characteristics. "
And "...bubbles of this type are formed by sequential star formation over time scales shorter than previously found for some super-bubbles."

As all this implies, in N11 we are seeing one big bright active 'Giant-Bubble' with many parts; a thing not seen in our MW Galaxy - and it's not small, but about half the apparent size of the Moon! (15arcmin). The sketch shows it in the ten inch Dob; a rich and glorious sight! Yet it's overlooked by many drawn to the LMC Bar and 30 Dor regions. Take a look further afield! N11 will be discussed in detail in future piece. We now turn to LMC Region 'S. Dor'.

Large Magellanic Cloud by Harry Roberts

Cont...2

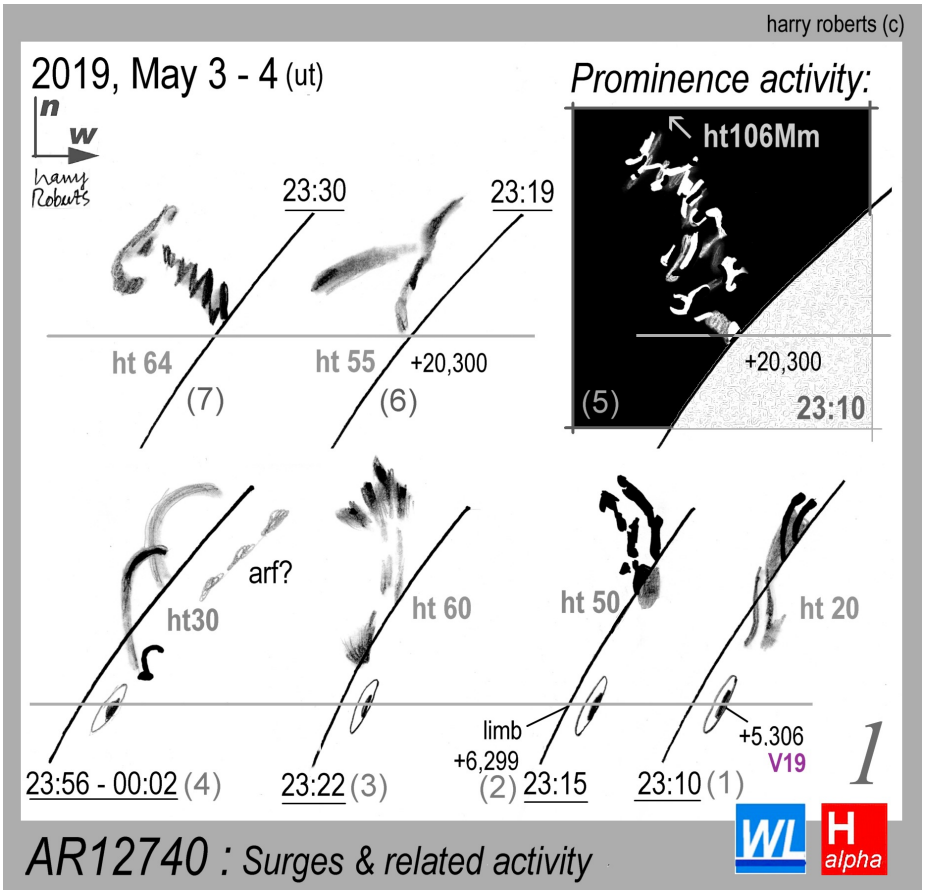
S. Dor. Nebula. Recall that we used the name of the major star involved, 30 Doradus, to name the '30Dor. (or 'Tarantula') Nebula', it's a useful name. The Mud Map shows at the west end of the LMC 'Bar' the S Dor. star, sited in another rich and complex object, comprising several open clusters, a two 'armed' nebula (Henize N119) and other 'riches'. In this case one cluster is named NGC1910. In the Mud Map we label the whole thing S Dor. (Aka NGC1910). It looks much like a spiral galaxy in a ten inch 'scope. The famous variable star S is a rare luminous blue variable, LBV, apparently unique in astronomy!

We have now named four major 'bits' of the LMC without resort to NGC numbers, as on the Mud Map. To recap: they are '30. Dor', the LMC 'Bar', 'N11', and 'S. Dor.' Two major 'bits' remain. In Mud Map 3 we will revive two Harlow Shapley names (1930's) that, while still used in research, are seldom heard in amateur circles.
More on this in the final instalment on the most remarkable 'object' in the entire sky: The Large Magellanic Cloud.

Solar News by Harry Roberts

AR12738 Returns: Surging Renewed!

It had been a while since any spot group made a second passage of the Sun's disc. AR12738 farewelled us with impressive displays of bright ejections (surges mostly) as it passed behind the west limb on 2019, April 19. The big 'simple' spot, likely the only survivor of a complex bipolar group, had a vast 'train' of plage, faculae, filaments and surges, over 15deg of longitude, in its 'wake'; an impressive sight on its first transit. The big spot lay at lat +7, long.298 (+7,298).



Its return was uncertain; but such spots are the longest lived, as I recall. Two weeks later, May 5, a 'new' and very similar spot was logged, at +5, 306. Allowing for a little westward proper motion – normal for such spots – it was clear that 2738 was back; attended by a rich mix of solar transients (Fig1). It was renamed AR12740.

This time limb activity was stronger than on first limb transit (April 6th), with multiple centres on the limb (Fig). At lat +13 to +15 surges and other ejections hurled bright material above the limb. H-alpha brightness estimates are made relative to the chromospheric disc which has value 1.0. A solar flare has value twice the disc and can be much more. No flares were seen. Most ejecta had brightness between discx0.8 to 1.0.

H-alpha logs began at 23:10 - when a superb prominence was seen: thin thread-like material (like Mandarin calligraphy) rose to >100Mm Fig1(5), not collimated like a surge, it lay at Lat +20, well away from the spot. Yet this material soon faded and rapidly evolved, (6) and (7), into more regular shapes: adjacent coronal fields at work maybe. This prominence may have been a quiet region filament (QRF) that was reshaped by ejecta from the sunspot.

Meanwhile, conventional surges (collimated ejected from the big spot) were erupting; one seemed spray-like, Fig1(3): *"ejecta of a flare"* (Zirin, p298.) A GOES C1 flare at 23:31 went unseen; a limb event maybe?

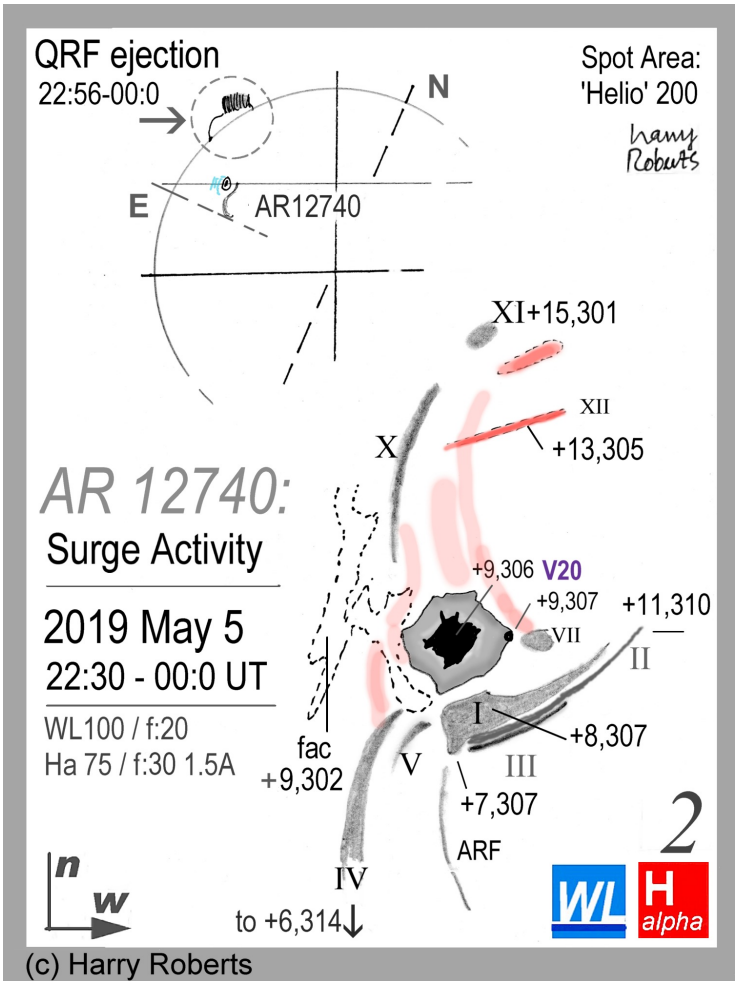
Solar News by Harry Roberts

Cont….2

Surges: viewed from above (Fig2). So far we have viewed these solar transients 'side-on', at the limb, when they appear as arches or 'jets' of bright material against the black sky and the host spot is barely visible.

Viewed from above, with the spot say 30deg from the limb (Fig2, 2019 May5-6), the site looks very different. During its first transit 2740 showed many surges in action – but on May 5 it had a "storm" of surges. Zirin (p278) notes that surges are Doppler-shifted about *'minus-one Angstroms'* as line-of-sight velocity is ~50km/s - and searching the band (tuning) will usually show them. Fig2 shows nine (Roman Numerals), with some omitted for clarity (field notes very cluttered)!

Of the surges shown most were dark, slender and curved. One (I) was sheet-like. One or two were bright (1.5Xdisc). Video of such events would be useful. The tuning was in constant use. All were transient; only an active region filament (ARF) S of the spot was stable throughout.

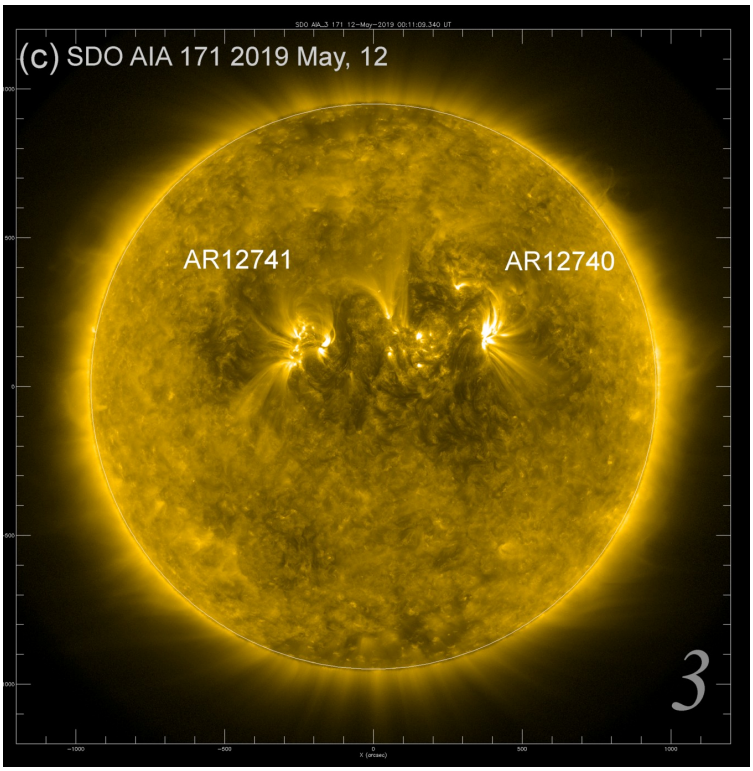


QRF Ejection: Quiet region filaments (aka Quiet Prominences) are rare at present – yet a bright one lay between lat.20 – 30 deg at 22:56 (Fig2). It was quite unstable – lifting off slowly for 64 minutes, to 63Mm high, when it was almost invisible: a pretty sight! Recall the tall prominence of May 3, Fig1(5) at lat+20deg). Was spot activity responsible for both ejections – effects that extended over 30deg lat.?

Solar News by Harry Roberts

Cont….3

Coronal Hole/s. We noted that 2740 was sited in a coronal hole during its first transit (April, as 2738). By May 6 (UT) it is joined by a new larger spot (2741) 35 deg E of it at similar latitude. SDO 171Å log, Fig3, shows BOTH apparently in an enlarged "Hole"; or has a new hole joined the old one? This is likely unusual. We note both spots are Violet (V) polarity – perhaps the holes are the same.



The SDO Fig3 shows that the spots coronal loops 'like' to connect to solar surface fields outside their hole! Further work is needed on this.

Events here presented show just a small part of the activity recorded between April 7 to May 19,2019, in the writers time zone. A GOES M1 flare on May 6, 05:09UT went unrecorded. An anomalous event of almost zero duration, it suggests instrument error. No other records seem to have been made.

More Club News continued from page 1

The AGM was held at the July 2018 monthly meeting. Elected officials for 2018 - 2019

President: Frank Gross
Vice President: John Gould
Secretary/Treasurer: Tracey Newcombe
Public Officer; Frank Gross
Observation Officer: Robert Turnbull
Editor: Kaye Johnston
Librarian: Chris O'Hanlon

The Committee: Robert Turnbull, Rudolf Henssen, Robert Spruyt, Jack Apfelbaum, Chris O'Hanlon, John Gould

Check out the Astro Flyer on the web site: www.shoalhavenastronomers.asn.au

Shoalhaven
Astronomers
PO BOX 1053
Nowra NSW 2541

The deadline for Articles for the Astro Flyer is The First Friday of the Month.

Editor Kaye Johnston

Club Video Projector Rental

The Video Projector is available for club members for a small rental fee. If a club member would like to project a football game, cricket game onto a wall for a party this is the way to go. You will get up to a 100 inch diagonal picture on a light coloured wall with the Epson video projector. The projector has an inbuilt speaker but you can add your own speaker units if necessary. The unit s very easy to use and instruction would be given before the borrowing (2 days) occurs. The rental price is set at present at $15 for two days.