Shoalhaven Astronomers Inc.
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Astro Flyer

APRIL 2023

Club News

From The President

A big thank you to all who have participated in the refurbishment, preparation and assembly of the observatory – it looks great! See page 10

The remaining components of the observatory and the equipment that will go inside it will be progressively installed over the coming months. I will call for assistance for each stage as the materials and components come together.

Again, my thanks to the many willing helpers along the way that have got us to this point and I look forward to working with you in the future..

A reminder that our AGM will be held in the June/July timeframe where we will be electing a new executive and committee for the following year. Please consider how you can contribute by taking on one of the executive positions or serving on the committee. None of the positions carry a high workload and all can be very rewarding. Give it a go!

In the meantime – keep on watching!
Best Regards, Mark Town

Next Meeting April 21 7 for 7.30pm

Contents

Out There
Bob Turnbull
page 2

Astro Events Frank Gross pages 3-11

Rümker Sunrise
Harry Roberts
Pages 12-13

Planetary Nebula
NGC 4361
Andrew Wood
Page 14

More Information
Page 15

MOON PHASES

New Moon	First Quarter	Full Moon	Last Quarter
Apr 20th	Apr 28th	May 6th	May 12th

Viewing Nights

We are aiming, once daylight saving is over, to make observing at Friday meetings a priority if the weather permits.

New and Last Quarter moon phases are good times for Dark Sky Observing.

OUT THERE BY BOB TURNBULL
OBSERVATION OFFICER

March-April

March

Mercury and Saturn are close, also Venus is close to Jupiter and Uranus.

Mars is close to M35 and the time to see the Emu is shown in Autumn Sky – page 37.
Saturn and Mercury are seen in the dawn sky March 3rd to 20th.

M44, the Beehive cluster is in Cancer.

April

The appearance of planets have changed little from March, however some are declining. Check them quickly when they are in a good dark place for viewing!!

The moon will be at apogee (at furthest from earth 405,889km) however wait until 20th March when it will be at its closest (362,696km).

The article about the Moon base Alpha (p) 34, is worth reading.

Comets: for March on (p) 35 may tickle your interest. I hope you gain some joy from at least one of them.

Keep looking up to click on a chink in the clouds. April (p) 39 and the solar eclipse April 20th Exmouth WA (Maybe this event will be televised to let us easterly viewers get a chance to see it)

Good skies and rewarding viewing.

Bob Turnbull
Observations Officer

Astro Events from Frank Gross

According to a new report, NASA could launch a orbital-only mission to Mars in 2033. Credits: NASA

POSTED ON APRIL 1, 2023 BY MATT WILLIAMS
2033 is the Perfect Year to Send Humans to Mars (With a Bonus Venus Flyby)

In the coming decade, NASA and China plan to send the first crewed missions (astronauts and taikonauts) to Mars. Both agencies hope to begin sending missions by 2033, coinciding with a Mars Opposition, followed by additional missions in 2035, 2037, and after. These missions will culminate with the creation of a Mars surface habitat that will enable future missions and research. Launch opportunities for these missions are limited because the distances between Earth and Mars vary considerably over time, ranging from about 56 million km (~35 million mi) to more than 400 million km (250 million mi).

The times when Earth and Mars are at their closest (known as a Mars Opposition) only occur once every 26 months. Moreover, using conventional propulsion methods, it takes missions six to nine months to travel between Earth and Mars. As a result, round-trip missions to Mars could take up to three years, dramatically increasing radiation exposure for the crew and the time they spend in microgravity. According to a recent study from NASA's Jet Propulsion Laboratory (JPL), 2033 will be a unique opportunity to send a crewed orbital mission to Mars that lasts just 1.6 years.

The study, which appeared in the *Journal of Spacecraft and Rockets*, was led by Humphrey "Hoppy" Price, the chief engineer of NASA's Mars Exploration Program and the architect of the JPL plan for a minimal-architecture crewed mission to Mars. He was joined by Robert Shishko, a principal system engineer and economist at JPL's Mission and System Architecture Section, JPL senior systems engineer Joseph Mrozinski, and JPL systems engineer Ryan Woolley.

Mars Ain't Easy!

According to the authors, NASA's "Journey to Mars" program and a 2033 deadline is not feasible using the architecture referenced in the NASA Transition Authorization Act of 2017 and the NASA Authorization Act of 2020. This was the conclusion reached by the Science and Technology Policy Institute (STPI) in an independent analysis titled "Evaluation of a Human Mission to Mars by 2033." Specifically, they identified several methods and technologies integral to the mis-

Astro Events from Frank Gross

Cont...2

This included long-duration life support systems (LSS), 500-kWe-class Solar Electric Propulsion (SEP), zero boiloff (ZBO) cryogenic propellants, and liquid oxygen (LOX) produced on Mars. Refueling and reusability were also identified as "medium-risk" requirements. Other issues identified by STPI included timelines, funding, the Deep Space Transport (DST), and the difficulties imposed by parallel developments between the Artemis Program and the "Journey to Mars." As the STPI team concluded in their report:

"STPI found that a 2033 departure date for a Mars orbital mission is infeasible under all budget scenarios and technology development and testing schedules, given NASA's current and notional plans. 2035 may be possible under budgets that match 1.9 percent real growth, but carries high risks of schedule delays due to complex technology development, testing, and fabrication schedules for the DST; may require reducing the scope of lunar missions; and reduces NASA's ability to mitigate risks to human health."

The DST is an especially tricky point, according to the STPI report. As per NASA's "Journey to Mars" architecture, this spacecraft would be integrated with the Lunar Gateway by the late 2020s. It would rely on solar-electric propulsion and either include a habitable volume or use the Orion spacecraft in lieu of. Assuming there is a small boost in funding and budget consistency during the 2030s, the STPI anticipates that the DST will not be ready to depart until 2037. Assuming that delays and budget shortfalls are a factor, they anticipate 2039 is a more realistic date.

Price and his colleagues also addressed the potential for nuclear propulsion and in-situ resource utilization (ISRU), which comes up often in the context of future missions to Mars. According to various proposals, nuclear-thermal and nuclear-electric propulsion (NTP/NEP) could reduce transit times (45 to 90 days), radiation exposure, and the amount of time astronauts spend in microgravity. Also, ISRU offers the potential for lower payloads and less propellant, since materials and fuel could be manufactured on Mars. However, they also state that these technologies pose "development challenges and risks" and probably won't be ready by 2033.

This echoes the findings of the Ninth Community Workshop for Achievability and Sustainability of Human Exploration of Mars (AM IX) workshop. Here too, NTP/NEP was raised as a possible means of reducing transit times and the associated health risks, which was naturally met with enthusiasm by many members. However, according to AM IX Report, critics of this idea "cited studies that suggested neither NTP nor NEP would be available in the human exploration time horizon of interest."

Launch Opportunity

What is needed, therefore, is a mission architecture that avoids the higher-risk technologies identified by the STPI's analysis and minimizes the number of new vehicles and developments required. Accordingly, Price and his colleagues propose a round-trip mission launching in 2033 that would take advantage of a unique planetary alignment (Venus-Earth-Mars) that occurs about once every 15 years. The mission would perform a gravity assist maneuver via a Venus flyby, accelerating the spacecraft and reducing the necessary propulsion and the total mission time.

The mission would begin with the spacecraft flying to Mars, spending about 30 days in high orbit, and then returning to Earth via the Venus gravity assist. The mission would last about 570 days (1.6 years), dramatically reducing the radiation the crew is exposed to and the time spent in microgravity. Another major advantage is that this mission architecture would rely on existing technologies and vehicles that are currently in production – like the *Space Launch System* (SLS) and *Orion spacecraft* – or in the study contract phase for the Artemis Program.

They also emphasize that this mission would likely be on-orbit only, meaning there would be no landing involved, but could still serve as a precursor for future missions to the surface. As the team stated in their study:

"This would be an orbit-only mission as a precursor to landing missions that would follow, similar to how the Apollo 8 lunar orbit mission was a precursor to the Apollo 11 landing mission. Having a crewed Mars lander available for a 2033 mission, although potentially feasible, is unlikely due to the funding commitments

Astro Events from Frank Gross

Cont...3

that would be needed for such an effort. However, if private commercial efforts would be able to produce a crew qualified lander by 2033, then a landing mission could be considered."

A Mars Mission Vehicle

Price and his team include a proposal for a Mars Mission Vehicle (MMV) consisting of an Orion spacecraft and three propulsion stages that would rely on conventional engines (like the RS-72 or XLR-132) and non-cryogenic bipropellants – like nitrous oxide (N_2O_4) and monomethylhydrazine (MMH). The MMV would be launched by the SLS and commercial rockets and assembled in High Earth Orbit (HEO) or around the Moon using the Lunar Gateway. The crew would launch aboard an SLS and rendezvous with the MMV as the final element in the assembly.

The concept is an adaptation of a community-developed architecture formulated at the Fifth Community Workshop on Achievability and Sustainability of Human Exploration of Mars (AM V) workshop held in 2017. The elements include:

1 An Orion spacecraft to transport crew to the MMV in HEO and provide direct-entry Earth return
2 A Mars Transit Habitat (MTH) to provide accommodations and life support for the crew
3 An Earth Departure Stage (EDS) to perform the trans-Mars injection (TMI) burn in HEO
4 A Mars Orbit Insertion (MOI) stage
In addition, two Trans-Earth injection (TEI) stages would be sent ahead of the MMV to provide transportation back to Earth by way of a Venus flyby. A sunshade would be deployed for thermal control during this phase since the spacecraft will be within 1 Astronomical Unit (1 AU) of the Sun. As mentioned before, the mission architecture and MMV design incorporate technology that is already in production or within reach.

While only the SLS and Orion are currently in production, the authors stress that the other elements are on the drawing board for NASA and its industry partners. In particular, there's the Mars Transfer Habitat (MTB), which NASA has been developing since it announced at the 2017 IEEE Aerospace Conference that contracts were being awarded for Deep Space Habitation (DSH) studies. Price and his teammates further estimate that an MTH could be tested at the Lunar Gateway by the late 2020s and be ready by 2033. As they write:

"The MTH is currently in NASA's planning process to be developed and to have the first delivery version tested at the Lunar Gateway. The EDS, MOI, and trans-Earth injection (TEI) stages would be of a common design with identical components, except for the tank lengths and capacities, which would be of three different variants. The stages would be manufactured from a common assembly line using conventional space-storable hypergolic propellants with systems that are currently at a high technology readiness level (TRL)."

Mission Profile

According to the timelines established in this study, the mission would begin by mid-2028 with the launching of the MMV elements to Earth and Mars orbit. Four SLS and 13 commercial launches would be used in total, with a combined payload mass of about 1020.5 metric tons (1125 tons). First, two SLS Block 2 Cargo and ten commercial launch vehicles would send the two TEI stages toward Mars, where they would position themselves and dock together once in HMO. Second, one SLS Block 2 Cargo and three commercial launches would deliver the mission vehicle to HEO.

These would be fully assembled and ready for final inspection and validation by late 2032. Last, a single SLS would deliver the crew and their Orion spacecraft to HEO to dock with the mission vehicle. The mission would then depart for Mars in 2033 based on the following timeline:

"The crew would launch in SLS/Orion in late March or early April 2033 to dock with the mission vehicle in the departure orbit in HEO. Again, the launch date for the crew would not be critical, and so there would be flexibility to accommodate some delays. In April 2033, with a departure period of a few weeks, the TMI burn would be performed, and the mission vehicle would depart for Mars. After about a 200-day transit, the mission vehicle would arrive at Mars in November 2033 and perform the Mars orbit insertion burn into HMO."

Cont...4

The mission would spend about 30 days in orbit, at which point the MOI stage would be jettisoned, and the mission vehicle would rendezvous with the two TEI stages to return home. The return phase of the mission would last about 340 days and include the Venus flyby that would put the MMV on course to loop around the Sun and return to Earth. A few days before the spacecraft reaches Earth orbit, the Orion would separate from the MTH, leaving it on a course to fly past Earth. The Orion would then perform a final burn to reenter Earth's atmosphere and achieve splashdown.

In addition to their 570-day mission profile, Price and his colleagues also offer an alternative conjunction-class long-stay mission. This mission would still launch by April 2033 and last about 950 days (2.6 years), with a 550-day stay in Mars orbit. This profile would require fewer launches from Earth and only one TEI stage to accomplish the return portion of the mission. It would also require far less acceleration to break free of Earth's gravity and achieve an MOI, but would also need a much larger acceleration to depart from Mars orbit and a significantly greater burn from the TEI modules.

This mission comes with some additional risks, mainly from the extended period spent in microgravity and the increased exposure to radiation. So while the 950-day mission is simpler, would cost less, and involves fewer technical challenges, these come at the cost of increased risks to human health and safety. The long-duration stay in Mars orbit also leads to the same logistical difficulties identified in NASA's current mission proposals, not the least of which are the need for long-duration life support systems, supplies, and waste management.

Follow-up Missions

Another selling point of this study is the recommendations for follow-up missions that would commence by 2037. This (they state) would require the development and qualification of a four-person Crewed Lander and Ascent Vehicle (CLAV) that could also be built using current technologies. Price and colleagues from NASA JPL and the Georgia Institute of Technology (GIT) outlined this vehicle concept in a previous study released in 2016. In this latest study, Price and his team explain how this vehicle could allow for missions every four years and could be delivered to HMO with two SLS Block 2 launches:

"The crew could travel to HMO using the same mission profile previously described and rendezvous with the prepositioned lander. After transferring to the lander, the crew would descend to the surface, perform a science exploration mission, and return to the mission vehicle in HMO using the lander's ascent vehicle plus a prepositioned boost stage to get from low Mars orbit to HMO. This would require the Mars ascent vehicle to rendezvous and dock with the boost stage in LMO in order to return to the mission vehicle."

The landing mission could also be adapted to their short and long-duration mission proposals, with the stays taking place on the Martian surface rather than in orbit. Over time, these landings could lead to the build-up of infrastructure on Mars and the utilization of local resources (ISRU) for refueling, construction, science operations, and other necessities. They also anticipate an eventual transition to reusable and more advanced propulsion systems allowing for shorter transits and longer stays.

This plan stands in contrast to previous proposals by NASA, which called for the possible deployment of a space station around Mars in 2028. Proposed concepts include Lockheed Martin's Mars Base Camp (MBC), which would be paired with a reusable Mars Lander to enable trips to and from the surface and serve as a fallback point in the event of major solar flares or other hazards. While cost assessments for the MBC are unavailable, it is a foregone conclusion that it would cost far more to construct, deploy, and assemble than the proposed CLAV.

Upsides/Downsides

One of the most obvious selling points of this mission architecture is its simplicity and cost-effectiveness compared to existing plans. In addition to the mass and performance estimates, the study provides a cost breakdown by year. In a 2015 op-ed, Dr. Olin G. Smith and Paul D. Spudis* estimated that the cost of NASA's Journey to Mars could be as much as $1.5 trillion. Moroever, their assessment was based on a significantly larger annual budget of about $54 billion per year instead of the then-current $18 billion ($68.54 and $20.5 billion today).

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Cont...5

In comparison, Price and his associates predict that a program lasting from 2023 to 2035 will cost $17.728 billion and would require a modest increase in funding (consistent with the STPI analysis). Their plan would also require fewer launches and less propellant, offers a Mars transfer vehicle that would be ready in time, and does away with the need for the Mars Base Camp. These advantages echo what Robert Zubrin proposed with his "Mars Direct" mission architecture, which similarly calls for direct flights to Mars, the necessary elements to be sent on ahead, and ISRU to reduce payload and mass requirements.

But perhaps the greatest selling point is that this mission would be ready to go by 2033 using technology that already exists (or will soon). No additional systems need to be invented, tested, and validated, the most notable of which would be NTP/NEP systems. Basically, the proposal offers a plan that is feasible, on budget, and on time, at least when compared to NASA's existing mission architecture. But of course, there are some obvious drawbacks, the most obvious being that it does not allow for surface operations.

As noted in a previous article, the AM IX Report was rather ambivalent about the feasibility and value of an orbital mission to Mars, despite the fact that it would easier to prepare and ready to go sooner. As the Report's authors wrote: "It was agreed that the opportunities offered by the 2033 launch window are not to be dismissed lightly (assuming crew readiness), but no consensus was reached as to the value of an initial orbital mission, and no consensus was reached on an initial conjunction vs. opposition mission."

Given the cost and timelines involved, any missions to Mars are likely to seem less appealing if no surface operations are involved, regardless of the potential for follow-up missions. After all, one of the main objectives of crewed missions to Mars is to build upon the astrobiological research performed by robotic explorers going all the back to the *Viking 1* and *2* missions in 1976. So while this proposed architecture would allow for missions by 2033, one has to consider if a delay might not be the preferable option.

Of course, the matter is complicated somewhat by the fact that missions to Mars are not so easily delayed, unlike missions to the Moon. Given the orbital mechanics involved, opportunities are largely confined to Opposition launch windows (once every 26 months). And even when Earth and Mars are at their closest, the distances involved always presents logistical, technological, and health and safety challenges. As such, any delays could push the first launch as far back as 2039 (as noted in the STPI analysis).

But it is this very insistence that NASA send the first crews to Mars by 2033, with-follow up missions every 26 months, that is creating these challenges. Consider the Artemis Program, which evolved from Phase I and II of NASA's Journey to Mars. Prior to 2019, the plan was to use the SLS to launch the elements of the Lunar Gateway to the Moon, which would then be assembled in a halo orbit and paired with a reusable lunar lander. Crewed missions to the lunar surface would follow by 2028, at which point NASA would shift its focus to developing the DST and sending crews to Mars by 2033.

However, the decision by the Trump administration to alter the timetable to make a lunar landing happen by 2024 resulted in a significant shakeup. Due to the constrictions imposed by this deadline, as well as delays with the SLS and other mission elements, the decision was made to deprioritize the Gateway. This not only forced NASA to contract with agencies to develop a Human Landing System (HLS) and to outsource the launch services for the Gateway. Both contracts were awarded to SpaceX, which will launch the core elements of the Gateway in 2024 (using a *Falcon Heavy*) and land the *Artemis III* crew using the *Starship HLS* by 2025.

Given all that, it might be preferable to postpone the first crewed mission to Mars to give various technologies and proposed solutions time to mature. Otherwise, NASA will have to adjust its plans and be ready to go with a lower-cost orbital mission by 2033. The fact that the Chinese also plan to send their first crews to Mars in 2033 might seem like an incentive to "get their first." But it is important to note that China is facing the exact same challenges and their technological readiness is no greater than NASA's.

This is especially true where "parallel developments" with lunar exploration programs arise. According to the official guide released by the China National Space Agency (CNSA) in 2021, the creation of

Astro Events from Frank Gross

Cont...6

the International Lunar Research Station (ILRS) will be a three-phase process that will last until 2035. Phase II and III of the program (2030-2035) are reliant on the *Long March_9* (CZ-9) super-heavy launch vehicle being ready on time. Roscosmos was to contribute to these phases with their *Angara-5*, but development of this super-heavy launch vehicle has stalled (largely due to sanctions resulting from the war in Ukraine).

Alas, any major decisions regarding future missions to Mars will depend on what happens as 2033 draws nearer. That includes how the Artemis Program unfolds, what the budget environment looks like, and the development, testing, and validating of new technologies. In the meantime, it’s good to know there are options. Whichever path NASA takes, the end result is sure to be both exciting and nspiring!

Astro Events from Frank Gross

Cont...7

Construction of Shoalhaven Astronomers, Inc Observatory Update

On April 1, 2023 members of the Shoalhaven Astronomers, Inc. got together under the direction of president Mark Town and put up the walls to the new observatory at the UOW, Shoalhaven Campus.

Mark Town and Steven Holloway working to level the walls of the new observatory. There were quite a few members of the Astronomers who volunteered for the working bee.

Astro Events from Frank Gross

Cont...8

When entering the interior of the observatory you will have to stoop a little.

The walls are up and after a much needed break the workers returned to batten down the sides to the concrete base and make sure the walls were all securely connected to each other.

Astro Events from Frank Gross

Cont...9

STOP PRESS! April 2, 2023 Shoalhaven Astronomer's finish the exterior construction of their new Observatory and it's a beauty. Well done to all those who lent their time to get this job done.

Rümker Sunrise by Harry Roberts

Karl Ludwig Christian Rümker was perhaps unique among 19C German astronomers, in that he spent nine years at Parramatta Observatory. He was, according to 'bios' "headstrong" and "somewhat violent", and his career was marred by "clashes" with others – a trait perhaps enhanced by his time as a mid-shipman in the East India fleet, and when "pressed" into the Royal Navy, where *"colourful"* terms were commonplace!

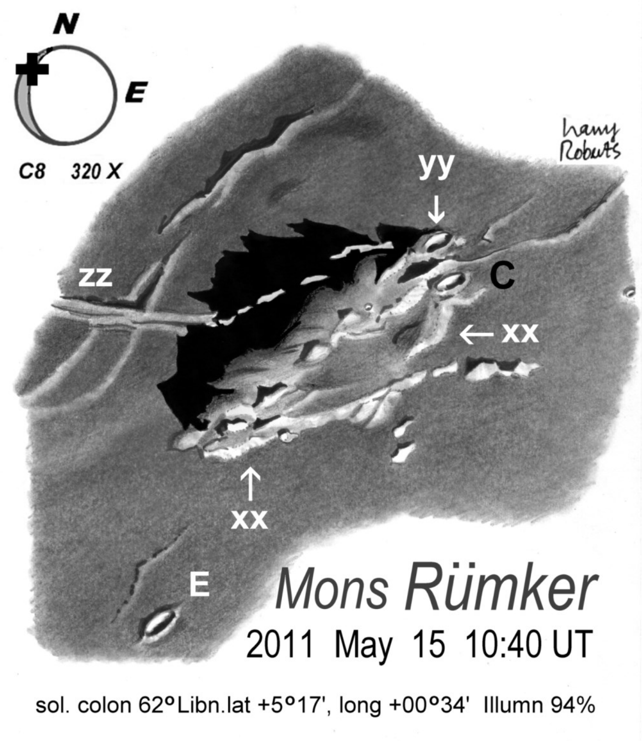
What drew him to Australia? Rümker learnt astronomy during his time at sea and was introduced to Thomas Brisbane by one of his officers. Brisbane needed an astronomer for Parramatta Observatory, and Rümker suited the job. Amazingly, he was granted 1000 acres on the Nepean, where he built a farm named "Stargard" (after his birthplace, a name he often used). While working at 'Parra' he rediscovered Comet Encke (1822) and it's there perhaps that he begun his catalogue of 12,000 southern stars. He was placed in charge of the observatory in May 1826, becoming the first to hold the title "Government Astronomer" in Australia.

Can we "dub" Rümker an honorary "Aussie"? Nine years is a fair while to spend here – but unlike his assistant James Dunlop, he did not make Australia his home– so perhaps we can't count him amongst the few "Aussies" memorialised on the Moon. The lunar feature named for him is, nonetheless, quite unique: Mons Rümker.

Mons Rümker is found in the Moon's NW corner, in Oceanus Procellarum (the Stormy Ocean) at a point where it branches to become Sinus Roris (Bay of Dew). In these vast lava tracts we suddenly find what looks like a 'desert island', complete with' lagoon'; this is Mons Rümker. Modern authors agree that Rümker is interpreted as a cluster of volcanic domes.

Chuck Wood in his commentary to the new "Kaguya Lunar Atlas" (a must have for moon-watchers) tells us (p116) that -

"Like a lumpy pancake… a broad volcanic dome, Rümker is 65km wide …of a flattened hemispherical shape. A couple of small volcanic domes occur near the top of Rümker." (There are actually at least four).



May 15 was clear and still, and the view of the Moon was stunning; at Rümker the sun's altitude was only 5º above the horizon, lighting the scene and throwing shadows 30km westwards.

The mounded shape was obvious, with bright scarps surrounding it (arrows **xx** in Fig) that rise to 1km high at the south side (Fig LHS). Behind these scarps is a shallow depression that some believe is a collapse caldera, sometimes called the "Lagoon".

Rümker Sunrise by Harry Roberts

Cont...2

Rising above the lagoon westwards, hummocky ground is topped by four or more bright conical domes that cast small shadows and are aligned roughly N-S. Further west the ground descends into shadow – where a bright-lit ridge cuts the gloom EW, towards “crater **yy**”. This “crater” is an illusion – the only real crater within Mons Rümker is labelled **C**. A tiny crater was also seen amongst the domes. At its highest Rümker reaches 1100 meters.

Nearby, dramatic wrinkle ridges transect the maria – they seem huge, but none can be higher than a few hundred meters. The same is true of the ridge that runs from **zz** to **yy** and on, out of view to the NE – it’s barely seen on Orbiter shots – but was stark at the time. This feature, which arises at a distance, cuts clean through the Rümker formation. Is it perhaps the source of the lavas that constructed the Moon’s largest volcanic feature?

Rümker is said to be badly placed for viewing, so near the limb, but I had great “astronaut’s-eye” views of a very complex, in fact unique, lunar landform – one that has a strong Australian connection.

Enjoy!

Planetary Nebula NGC 4361 Andrew Wood

This planetary nebula is within the prominent asterism of the major stars of the constellation Corvus. These five stars – oddly, the alpha star is actually the faintest of them – can be seen soon after dark at this time of year rising in the nearly due east above Spica, the brightest star in Virgo. Figure 1 shows the orientation of the asterism as we see it. Figure 2 is a representation of how it should look through a decent amateur telescope.

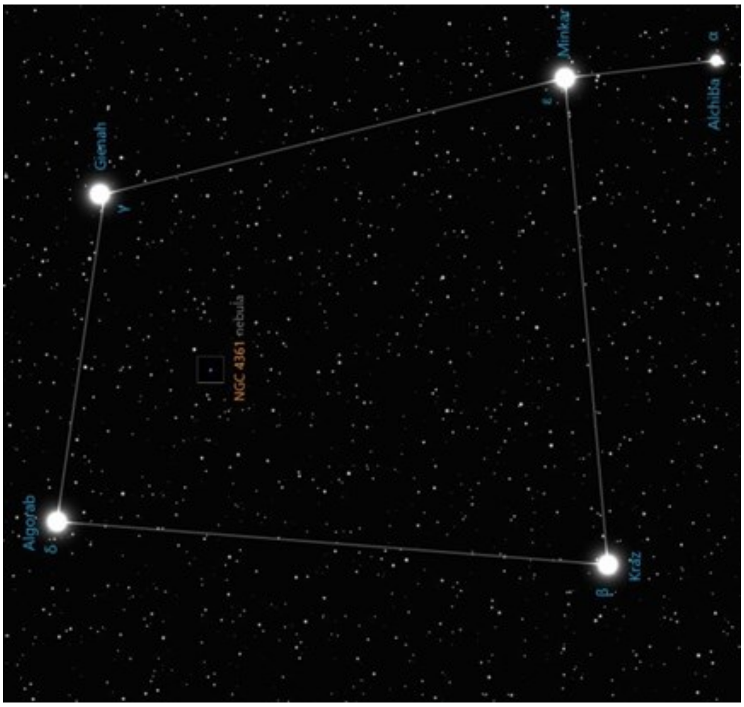


FIG 1. The major stars of Corvus, showing the position of NGC 4361. Ref: https://www.go-astronomy.com/constellations.php?Name=Corvus

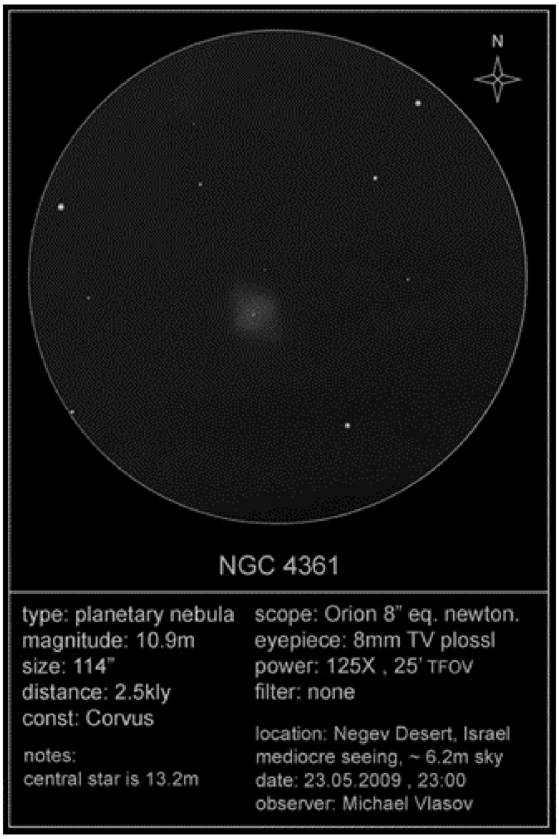


FIG 2. A sketch of NGC 4361 as seen through an amateur's telescope. Ref: https://www.cloudynights.com/gallery/image/13504-ngc-4361-sketch/

The nebula lies at the apex of a triangle formed by it and delta- and gamma-Corvi. As such it is easy to aim a telescope at, though at magnitude 11 you may need a dark sky or large aperture.

I have a recorded observation from Mt Keira, near Wollongong, using a 250mm f5.6 Newtonian and a 26mm Plossl (magnification 55x) way back in January 1998: "Very bright central star illuminating a large area of nebula. Better view without filter."

The filter used was a UHC. Interestingly, in *Hartung's Astronomical Objects for Southern Telescopes"*, (Malin and Frew revised edition 1995), the observation of NGC 4361 notes a *little* (my emphasis) improvement with an OIII filter.

This is a good visual object easy to find, and would also be a good subject for imagers.

More Club News

The AGM was held at the May 2022 monthly meeting. Elected officials for 2022- 2023
The 2021 AGM has been postponed due to Covid.

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Freya Bates,
Larry Wakelin,
Chris O'Hanlon,

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