Issue 259, August 2022

RASNZ NEWSLETTER

In this issue

Mt. John Observatory.
Credit: Bernard Spragg

Message from the President

It's good to talk with you again especially as I am able to announce that we not only have a new editor of our Newsletter but also a very modern approach. But first up I should like to thank Alan Gilmore, who is handing over the editor's reins, for all his years of excellent and dedicated service. And now I would like to introduce our new editor, Erik Vermaat, a long term RASNZ member and contributor to RASNZ and to astronomy in general, who is already well known to many of you. Rest assured that Alan will continue to support Erik and provide inputs to future editions while Erik continues to improve what we offer in our Newsletters.

This has been a very interesting and busy period for RASNZ and its Council Members with a number of key achievements to report. Firstly, you may have noticed we have launched a new RASNZ website and membership management system. This followed an extensive review of software options, customisation of the selected software package and data transfer from our old system. This new system has been introduced to ensure RASNZ is able to provide the very best service to our members. Many thanks for all the inputs from all the Council and other members of the team, led by Steve Butler, who contributed to deliver the new look and the new content. I can safely recommend our new site to you and confirm that during the current transition period all efforts are being made to ensure its content is both relevant and up to date. Also, it includes a social media feed that provides extracts from the RASNZ Facebook page with information about upcoming events and interesting news items.

In mid-July I attended an all-day meeting in Wellington of the Royal Society of New Zealand for all its Constituent Organisations. During this meeting I took the opportunity to outline to attendees the mission and activities of RASNZ and how astronomy, being multi-disciplinary, might sometimes overlap with certain of their activities and that in such circumstances RASNZ would welcome mutually beneficial collaboration. I was also able to identify opportunities and resources available through the Royal Society that RASNZ would be able to access in the future.

The annual International Astronomical Union (IAU) conference was held in early August in Busan, South Korea. It saw two RASNZ Council Members in attendance, Professor John Hearnshaw and Dr. Nick Rattenbury. Two talks were given by John, the first entitled 'Light pollution: a unified global solution is needed for a global environmental problem' and the second 'Introduction to the professional-amateur Working Group and future plans'.

As part of your Council's aim to engage with the various RASNZ Sections and Groups, August has seen the first such engagement. This featured key members from the Variable Stars South Section outlining to a Council Meeting their recent activities and their plans for the future. It is planned that the next presentation be made by the Occultations Section. It is hoped that through such engagements

Message from the President (cont'd)

RASNZ members will get a better understanding of what these Sections and Groups are doing (and may encourage you to join) and Council will be in a better position to identify ways we can support these Sections and Groups.

As part of our plan to improve outreach to RASNZ members, August will see the very first in a series of live astronomy talks (via YouTube) given by expert members of the local and international astronomy community. The first such talk is scheduled for August 22nd and will be given by Professor John Hearnshaw. The subjects covered will relate directly to his talks to the IAU regarding the problem posed by light pollution and the need for a global solution and the IAU's pro-am Working Group and future plans. This and all subsequent talks will be recorded and so will give RASNZ members the option to view them either live or at any time in the future post the event.

By the way, starting next month and on a monthly basis going forward, this Newsletter intends to feature an Affiliated Society with the overall aim of letting you all know what is happening in the various regions throughout the country.

These are interesting times for astronomy in general and RASNZ in particular, with our focus being on providing an ever-improving service to our membership. Please feel free to contact me or any other Council Member if you have any ideas in this regard.

Nalayini Davies, FRASNZ.
President – Royal Astronomical Society of New Zealand.
president@rasnz.org.nz.

RASNZ Membership system

A reminder to ensure you have paid your subscriptions for the 2022 year.

Payments can be made here.

If you are receiving this newsletter and aren't a member of RASNZ, please consider becoming a member. Applications can be filled out in this form .

We have now migrated our membership records to to our new system. We sent out just over 400 emails asking you to check your details and to renew subscriptions if appropriate. Thank you to those who have checked in and a reminder to those who have not yet done this. Our emails were sent out on the 30 July, so please check your mail inbox and spam box for an invitation to update your details.

If you are a former member who doesn't want to maintain a membership we would like to hear from you as well so we can remove your details from our records. You can contact us directly at members@rasnz.org.nz

Thanks from the Membership Team.

Farewell SOFIA

SOFIA Reflections

As the Stratospheric Observatory For Infrared Astronomy (SOFIA) project gets ready to leave Christchurch for the seventh and last time of deploying here to study the southern stars, I wanted to reflect back on the project from my perspective.

I was hired in early 2009 to be a mission director on the flights, and to date I have flown more missions on SOFIA than anyone else in the program, over 350 flights. I have been on every southern deployment, and in fact consider Christchurch to be a second home away from home since I came here many times while in the US Antarctic Program before SOFIA.

It was a long and complicated path to get to the point where we are now, successful gathering infrared data at wavelengths of light other observatories cannot collect routinely due to water vapour found in our atmosphere. SOFIA was conceived as a larger follow-up project to replace the Kuiper Airborne Observatory (KAO) that came before it. In the 1990's astronomers wanted a bigger telescope to replace the 1-meter KAO telescope so they looked to the largest airplane available to put the largest telescope mirror into it they could fit. A Boeing 747SP was chosen as the airplane platform, with optics and engineering dictating the size to be 2.7 meters (with the central 2.5 meters usable during observations). Originally built for Pan Am, it was the first airplane designed to fly over the Pacific Ocean non-stop, allowing it to support our 10-hour missions at very high altitudes, typically 41,000 to 43,000 feet for much of the flights.

Our German partners from DLR, NASA's German counterpart, engineered the amazing 17-ton telescope that is gyroscopically stabilized for very accurate and stable pointing at targets with a 3-degree freedom of motion in any direction the counter turbulence and just the fact we are flying in an airplane travelling at 500 miles per hour (800kph). It is an amazing machine.

Since infrared light is blocked by most materials, there can be no 'glass' in front of the telescope, so the engineers had to design a big door that could open and close to expose the telescope to the open atmosphere without blockage. The door is approximately 3 meters wide, opening up in the side of the airplane to expose the telescope without obstructions. Many concerns were brought up, and with many meeting and discussions and wind tunnel studies, the final design ended up being another engineering marvel. The door's operation is so smooth, and so little affecting the airplane's flight, you cannot tell when the door is open or closed. In fact, we ended up putting a simple sensor light in to tell us when it's open or closed so we know it's state!

SOFIA works at long infrared wavelengths of light not accessible to ground-based observatories making it valuable to be able to observe the cold gas and dust in between the visible stars we see every

SOFIA Reflections (cont'd)

night. Generally, wavelengths longer than 30 microns. Over the years since we started observing in 2010, we've mapped star forming regions such as 30-Doratis, Eta Carina, and the Orion Complex areas. We've observed the gas and dust surrounding newly forming stars and stars that are dying. We have peered into our galactic central region and begun studying the magnetic fields in the area. We've also observed other galaxies and how their star production and magnetic fields compare to our galaxy. It is a rich field for observing our universe that has only been looked at for the past 50 years or so.

We have also been able to fly members of the press, and teachers who would bring back their experiences to their readers and students to share what it takes to gather the data that helps expand our knowledge of the universe. One special guest we had on board a few years ago was Nichelle Nichols, known as Lt. Uhuru from the original Star Trek show. She had been a long time promoter for NASA, recruiting younger generations into the space program.

Our southern deployment this year was cut short due to a wind gust that pushed the air stairs used to access the airplane on the ground, causing damage we couldn't recover from quickly. Sadly, the decision was made to head home as soon as necessary repairs could be made and the flight home accomplished so that we could continue science observations from home.

In 2015 a similar wind event happened from a gust of wind at Christchurch airport that caused some damage to the airplane on the day we were supposed to fly and observe an important Pluto occultation. With some heroic effort from our team and help from Air New Zealand, the damage was repaired and we were able to fly later that night. This occultation happened just before the New Horizons space probe flew by giving us incredible images and science data close up, supported by our observations.

We are all sad that SOFIA is ending its mission at the end of September this year. All projects have a starting and ending date, so we are sorry to have to wrap things up after we return home, but it's been an incredible journey for the past 13 years for me. I have never worked with a more dedicated crew than this crew of SOFIA, always willing to whatever it took to get our observations done in spite of the many obstacles thrown in our path along the way.

I will retire after this, after spending my career studying infrared astronomy, but the studies will continue, and other projects will come along to further our knowledge of the universe.

Charlie Kaminski

SOFIA with its characteristic roar, taking off from Christchurch for the last time. Credit: YeahNah Productions (edited).

SOFIA 2015 - 2022

I have been fortunate from 2015 till 2019 to be able to facilitate for the members of Canterbury Astronomical Society (CAS) to have the ground based on-board tours of SOFIA when she has been on her southern deployments based at Christchurch Airport.

Each year I contacted the public affairs officer (Nick) and was able to organize the onboard ground tour for 15-20 members. I could also accompany each tour myself.

Sofia did not have a southern deployment in 2020 or 2021 due to the world wide covid-19 situation.

Sadly this year 2022 due to covid there were no group tours and with it being the last deployment to Christchurch with the announcement made in April 2022 to end operations no later than 30th September 2022.

In the years when SOFIA visited Christchurch, CAS was able to host the various crews for a number of talks to both members and the wider public, We also hosted them at our observatory for events like our yearly mid-winter BBQ's and Bonfire nights.

During the deployment, the SOFIA team also took part in multiple outreach events, sharing information about the observatory and its science with students in grades K-12, youth groups, museum attendees, and members of the aerospace industry.

2022

SOFIA arrived in New Zealand on June 18 and had a successful and productive month of science flights. Using two instruments, HAWC+ and GREAT, SOFIA observed and studied a wide range of celestial objects and phenomena, like cosmic magnetic fields, structure of the Milky Way, and the origin of cosmic rays.

Damage to the Plane ends flights for Christchurch Deployment

(news release from nasa):

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is adjusting its science observation plans and canceling the remainder of its Southern Hemisphere deployment following damage to the aircraft caused by severe weather on Monday, July 18. [...] The SOFIA team has determined the needed repairs will take at least three weeks, eliminating the possibility of conducting the remaining science observation flights that were planned from New Zealand through 7 August.

SOFIA departed Christchurch to return to her home base in Palmdale USA, 12.30pm on Thursday 11th August 2022 with a final fly-pass over the city and a final wing wave to those watching from the airport.

Not only we at Canterbury Astronomical Society, but I am sure all astronomy loving New Zealanders are sad to see them go. We have become friends with these wonderful people of SOFIA and we will keep them in our hearts. We wish them all the best for their future endeavours.

Dale Kershaw, Canterbury Astronomical Society.

IAUGA 2022

Professor John Hearnshaw FRASNZ, FRSNZ is just back from the International Astronomical Union (IAU) General Assembly in Busan, South Korea, complete with jetlag and COVID.

He gave two presentations:

Light pollution - a unified global solution is needed for a global environmental problem

Abstract: *Light pollution from artificial light poses a global environmental crisis, comparable in severity to global warming by greenhouse gases, to plastics in the oceans and to industrial air pollution in many of the world's megacities. However, the dangers of light pollution are far less widely recognized, even though it is adversely impacting human health and the environment right now, as well as astronomical science.*
A unified global solution is needed to address an urgent global environmental problem. There are many international agencies and organizations that can help tackle light pollution, and some are doing so already. But several more need to be lobbied. These include UNOOSA, COPUOS, IDA and IUCN (all of which are already engaged) and also WHO, ISC (the International Science Council), UNESCO and the OECD Environment Directorate. In addition, national academies of science in leading countries should be lobbied to approach their national governments.

Introduction to the IAU's pro-am Working Group and future plans

Abstract: *The IAU working group for professional-amateur relations in astronomy (for short, the pro-am WG) was formed in April 2021 as a WG under the Executive Committee. The IAU Strategic Plan 2020-30 stated that connecting professional and amateur astronomers was one of its goals for the decade (see Strategic Plan, Goal 4). This is also an integral mission of the IAU Office for Astronomy Outreach.*
For the first century of its existence, the IAU has had very few formal contacts with the much larger body of amateurs around the world. This changed in 2019 with a successful one-day workshop for amateurs in Brussels, followed by the formation of the new Working Group in April 2021 for professional-amateur relations in astronomy.
A database of many of the principal amateur astronomical societies, associations and groups around the world has been established (which includes RASNZ) and future plans are under development.

John will give a summary of both talks under the title: "*A Global Approach to Light Pollution & The Future of Pro-Am Observing*" on **22 August** at 19:30 NZT that will be live-streamed here.

Meteors raining down on New Zealand

Why are some bright green?

New Zealand may seem to be under meteor bombardment at the moment. After a huge meteor exploded above the sea near Wellington on July 7, creating a sonic boom that could be heard across the bottom of the South Island, a smaller fireball was captured two weeks later above Canterbury.

Fireballs Aotearoa, a collaboration between astronomers and citizen scientists which aims to recover freshly fallen meteorites, has received a lot of questions about these events. One of the most frequent is about the bright green colour, and whether it is the same green produced by auroras. Green fireballs have been reported and filmed in New Zealand regularly. Bright meteors often signal the arrival of a chunk of asteroid, which can be anywhere between a few centimetres to a metre in diameter when it comes crashing through the atmosphere. Some of these asteroids contain nickel and iron and they hit the atmosphere at speeds of up to 60 km per second. This releases an enormous amount of heat very quickly, and the vaporised iron and nickel radiate green light. But is this the same as the bright green of an aurora? For the most recent meteor, the answer is mainly no, but it's actually not that simple.

The colours of a meteor trail

The green glow of the aurora is caused by oxygen ions in the upper atmosphere, created by collisions between atmospheric oxygen molecules and particles ejected by the sun.

These oxygen ions recombine with electrons to produce oxygen atoms, but the electrons can persist in an excited state for several seconds. In an energy transition known as "forbidden" because it does not obey the usual quantum rules, they then radiate the auroral green light at 557 nm wavelength.

A meteor can also shine by this route, but only if it's extremely fast. Very fast meteors heat up in the thin atmosphere above 100km where auroras form.
If you want to see a green auroral wake from a meteor, watch out for the Perseid meteor shower, which has now started and will peak on August 13 in the southern hemisphere.

Also arriving at about 60km per second, the Perseids are extremely fast bits of the comet Swift-Tuttle. Some Perseids trail a beautiful, glowing and distinctly green wake behind them, particularly at the start of their path.

Once the Canterbury meteor hit on July 22, the capricious winds of the upper atmosphere twisted the gently glowing trail, resulting in a pale yellow glow towards the end (as seen in the GIF below, also recorded by Greg Price for an earlier meteor). This is caused by sodium atoms being continuously excited in a catalytic reaction involving ozone.

Are we being bombarded by meteors?

Yes and no. The arrival of big, booming green meteors and the dropping of meteorites isn't rare in New Zealand, but it is rare to recover the rock. Fireballs Aotearoa is working to improve the recovery rate.

In an average year, perhaps four meteorites hit New Zealand. We're encouraging citizen scientists to build their own meteor camera systems so they can catch these events.

By comparing the meteor against the starry background and triangulating images caught by multiple cameras, we can pin down the meteor's position in the atmosphere to within tens of metres.

Not only does that help us find the rock, but it tells us what the pre-impact orbit of the meteoroid was, which in turn tells us which part of the solar system it came from. This is a rather efficient way of sampling the solar system without ever having to launch a space mission.

Fireballs Aotearoa is rapidly populating Otago with meteor cameras and there are half a dozen more in other parts of the South Island. The North Island isn't well covered yet, and we're keen for more people (in either island) to build or buy a meteor camera and keep it pointed at the sky.

Then next time a bright meteor explodes with a boom above New Zealand, we may be able to pick up the meteorite and do some good science with it.

Jack Baggaley, Professor Emeritus Physics and Astronomy, University of Canterbury.

Previously published in The Conversation. Reprinted with permission of the author.

Caption: Witness reports and high-resolution meteor cameras help to calculate a meteor's trajectory. This map shows the approximate trajectory of the July 22 meteor at the top of the red shape in the centre. Fireballs Aotearoa and International Meteor Association, Author provided.

ALMA Follows Up a Short Gamma-Ray Burst

A distant neutron-star merger unleashed one of the most powerful short gamma-ray bursts (GRB) ever seen, according to new observations by ALMA, the Atacama Large Millimetre/submillimetre Array in Chile. Neutron stars are the super-dense stellar cores left after massive stars explode, and when two neutron stars collide, the result is a dramatic explosion, the light of which is referred to as a kilonova. The mergers also release gravitational waves and a brief blast of gamma-ray radiation in two tight jets shooting opposite directions into space.

On 6 November 2021, a short gamma-ray burst was detected by the European Space Agency's INTEGRAL X-ray and gamma-ray observatory, which sent out an instant alert that triggered NASA's Swift satellite, among others, to follow up. The burst, catalogued as GRB 211106A, lasted less than two seconds, but the afterglow from the kilonova shone for far longer as the jet of particles released by the merger excited the surrounding gas. "This short gamma-ray burst was the first time we tried to observe such an event with ALMA," Wen-Fai Fong, an astronomer at Northwestern University in Illinois, said in a statement. "Afterglows for short bursts are very difficult to come by, so it was spectacular to catch this shining so brightly."

Detecting the afterglow from the merger in the millimetre-wavelength light that ALMA is tuned to, gives astronomers an advantage when it comes to understanding these titanic explosions.

"Millimetre wavelengths can tell us about the density of the environment around the GRB," Genevieve Schroeder, also of Northwestern University, said in the same statement. "And, when combined with the X-rays, [the millimetre-wave light] can tell us about the true energy of the explosion."

As the GRB's jets, which move at nearly the speed of light, smash through the surrounding gas, the shockwaves accelerate electrons. The energy of the radiation from those electrons peaks at millimetre wavelengths, and therefore can tell astronomers about the total energy of the explosion. ALMA's measurements suggest that GRB 211106A released a total energy between 2×10^{50} ergs and 6×10^{51} ergs, which places it among the most powerful short GRBs ever detected. (One erg is equal to 10^{-7} joules; for comparison, the sun releases "just" 3.8×10^{33} ergs per second.)

It's particularly impressive that GRB 211106A was so bright, relatively speaking, since the merger happened sometime between 6.3 and 9.1 billion years ago, and the galaxy in which the merger took place is now approximately 20 billion light-years from Earth due to cosmic expansion. At this distance, the gravitational waves released by the merger were too feeble to detect.

Another advantage to come from observing with ALMA is that the afterglow at millimetre wavelengths lasts longer than in, say, X-rays. This gives astronomers more time to study the GRB jet, which begins as a narrow stream, then gradually opens out, like a laser pointer that makes a larger spot on a wall than the laser's base. Fong and Schroeder's team calculated the opening angle of the jet to be 16 degrees, which is the widest ever measured for a short GRB.

ALMA Follows Up a Short Gamma-Ray Burst (cont'd)

This is important because we only see a GRB when the jet is pointed toward us, so the wider the jet, the higher chance we have of seeing it. And the odds matter: Astronomers calculate the rate of neutron-star mergers in the universe based on how many short GRBs we see and estimates of their jet's opening angles. If more short GRBs have jets with wider opening angles, scientists may have overestimated how many neutron-star mergers are taking place.

The rate at which neutron stars merge isn't just an astrophysical curiosity — it has repercussions for cosmic chemistry. The conditions during neutron-star mergers are so intense that some of the universe's heaviest and most precious elements, such as gold, platinum and silver, are forged by these collisions. Indeed, scientists have estimated that a single neutron-star merger can produce between 3 and 13 Earth masses worth of gold. Hence the cosmic abundance of such elements is heavily dependent upon the rate at which neutron-star mergers take place.

While the collision is an act of cosmic alchemy, enriching the surrounding region with atomic treasure, the discovery has offered astronomers a whole new arena for studying short GRBs and their afterglows. "After a decade of observing short GRBs, it is truly amazing to witness the power of using these new technologies to unwrap surprise gifts from the universe," Fong said.

An artist's impression of a neutron-star merger (on the left) that produces a relativistic jet of particles that interacts with gas in the surrounding environment, producing an afterglow. (Image credit: ALMA (ESO/NAOJ/NRAO), M. Weiss (NRAO/AUI/NSF))

A paper describing the findings is set to be published in a forthcoming issue of Astrophysical Journal Letters; a preprint version was posted on August 1 at https://arxiv.org/abs/2205.03419 .

See Keith Cooper's original article at https://www.space.com/short-powerful-gamma-ray-beam-collision.

Hubble Sees Red Supergiant Star Betelgeuse Slowly Recovering After Blowing Its Top

Analysing data from NASA's Hubble Space Telescope and several other observatories, astronomers have concluded that the bright red supergiant star Betelgeuse quite literally blew its top in 2019, losing a substantial part of its visible surface and producing a gigantic Surface Mass Ejection (SME). This is something never before seen in a normal star's behaviour. Our Sun routinely blows off parts of its tenuous outer atmosphere, the corona, in an event known as a Coronal Mass Ejection (CME). But the Betelgeuse SME blasted off 400 billion times as much mass as a typical CME!

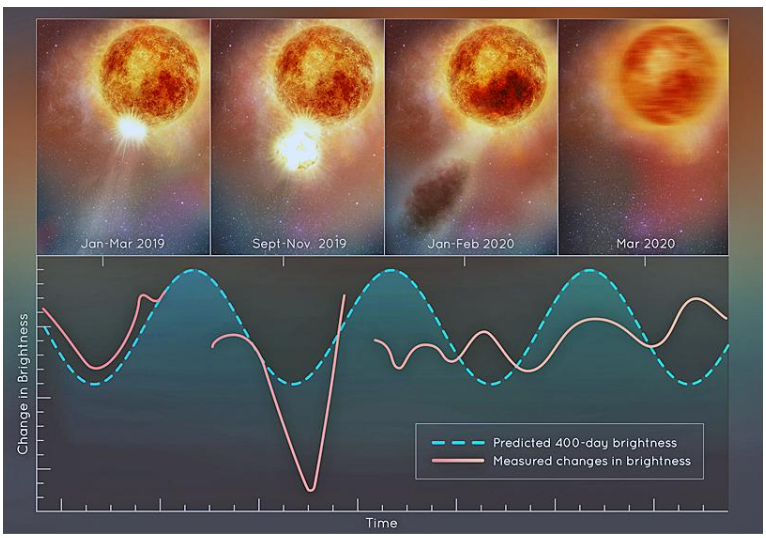
The monster star is still slowly recovering from this catastrophic upheaval. "Betelgeuse continues doing some very unusual things right now; the interior is sort of bouncing," said Andrea Dupree of the Center for Astrophysics | Harvard & Smithsonian in Cambridge, Massachusetts.

Image credits: NASA, ESA, Elizabeth Wheatley (STScI)

These new observations yield clues as to how red stars lose mass late in their lives as their nuclear fusion furnaces burn out, before exploding as supernovae. The amount of mass loss significantly affects their fate. However, Betelgeuse's surprisingly petulant behaviour is not evidence the star is about to blow up anytime soon. So the mass loss event is not necessarily the signal of an imminent explosion.

Read the full story here
https://www.nasa.gov/feature/goddard/2022/hubble-sees-red-supergiant-star-betelgeuse-slowly-recovering-after-blowing-its-top

Alan Gilmore comments:
We see more extreme examples of this kind of fading with R Corona Borealis variable stars (RCBs). They have sudden and unpredictable fades of several magnitudes due to a mass ejection condensing into dust. At Mt John Pam and I did photometry over many years of several RCBs for student projects. The photometry was combined with spectroscopic work to disentangle what was happening. A mass ejection on our line-of-sight, like the one Betelgeuse did, was the best explanation.



Moon Rocks from Earth

A new examination of six lunar meteorites found in Antarctica has revealed the first definitive proof that the moon inherited chemical elements from Earth's interior. The discovery adds support to the theory that our planet's most enduring companion was born when something massive slammed into the Earth in the distant past, also known as the giant impact theory.

During doctoral research at ETH Zurich in Switzerland, Patrizia Will discovered traces of helium and neon — both noble gases, which rarely bond to other elements — in six lunar meteorites from NASA's Antarctic collection.

The meteorites are composed of volcanic rock called basalt that formed as magma welled up from the interior of the moon then rapidly cooled. This cooling process created lunar glass particles within the samples that retain chemical signatures of solar gases. After the basalt formed, additional layers of rock enveloped it, protecting the glass from charged particles, both those from the sun's constant stream of solar wind and those from beyond the solar system, dubbed cosmic rays. The isolation preserved this fingerprint and guaranteed the origin of the gases trapped inside, the researchers reasoned.

Scientists were able to catch the fingerprints of helium and neon in the meteorites thanks to a particularly sensitive noble gas mass spectrometer that researchers nicknamed Tom Dooley after a Grateful Dead song. (Mass spectrometers sort out by weight elements within a sample.) "Finding solar gases, for the first time, in basaltic materials from the moon that are unrelated to any exposure on the lunar surface was such an exciting result," Will said in a statement.

Lunar research with impact

The finding supports the idea that a giant impact created the moon, and the work could also lay a roadmap for research into how the solar system's rocky worlds formed. One version of the giant impact theory proposes that a protoplanet called Theia smashed into Earth around 4.5 billion years ago, about 60 million years after the Earth itself formed. The impact must have been truly massive to throw out ejecta from Earth's interior that was able to remain in orbit and coalesce into another body, rather than falling back down to our infant planet.

Other lines of evidence that support this theory include the fact that the moon is lightweight, lacking large amounts of iron in its interior, while 30% or so of Earth's mass is in its iron-rich core. The moon's mantle rocks also have a similar composition to those of Earth, and these rocks are both significantly different from Martian meteorites.

Scientists needed a somewhat smaller impact to conduct the study. With no dense atmosphere like Earth's to burn up space rocks, the moon is constantly bombarded by asteroids. It was probably a high-energy impact from just such an asteroid that dug out rock fragments from the ejected rock fragments from deep within a large lava flow on the moon. These fragments eventually fell to Earth as meteorites; scientists spotted the dark space rocks against the blinding white of Antarctica.

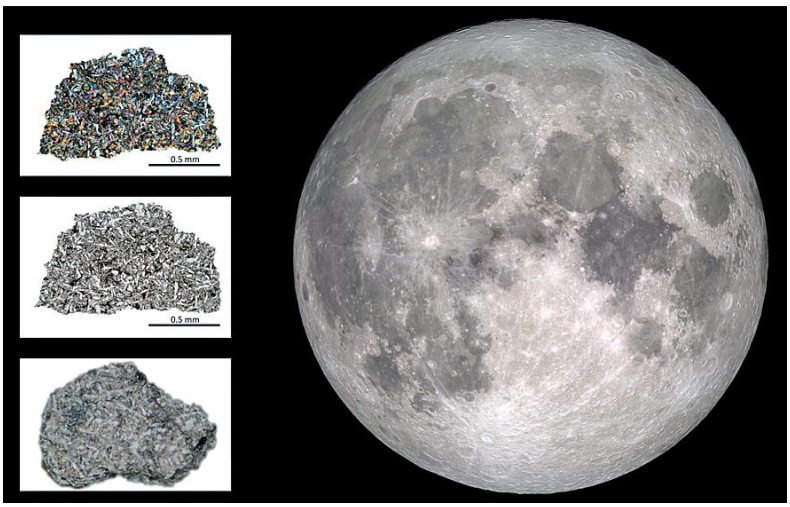
Moon Rocks from Earth (cont'd)

The researchers hope that scientists' understanding of far more than the moon could benefit from the team's work, since the current analysis targeted just a few of NASA's collection of around 70,000 meteorites. "I am strongly convinced that there will be a race to study heavy noble gases and isotopes in meteoritic materials," Henner Busemann, a geochemist at ETH Zurich, said in the same statement. He thinks that researchers will soon be looking to meteorites to find other noble gases like xenon and krypton that are more challenging to identify than helium and neon.

"While such gases are not necessary for life, it would be interesting to know how some of these noble gases survived the brutal and violent formation of the moon," Busemann said. "Such knowledge might help scientists in geochemistry and geophysics to create new models that show more generally how such most volatile elements can survive planet formation, in our solar system and beyond."

The team's findings are discussed in a paper published on August 10 in the journal Science Advances. See https://www.science.org/doi/10.1126/sciadv.abl4920

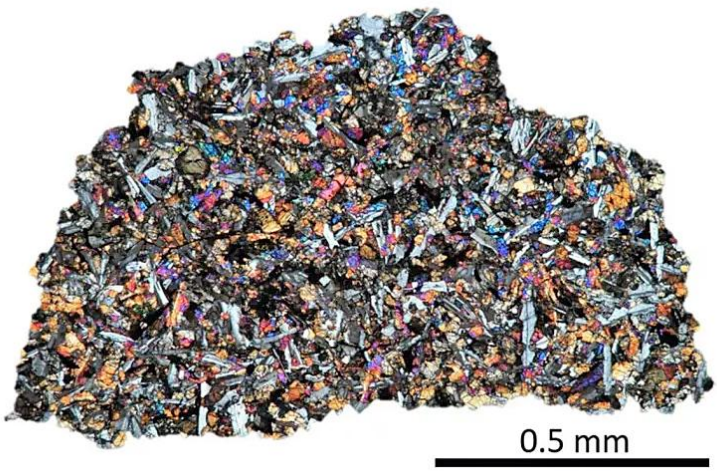
See **Robert Lea's** original article at https://www.space.com/moon-meteorites-noble-gases-from-earth.



Captions:
Samples of lunar meteorites add support to the idea the moon was formed when a massive space rock struck the Earth. (Image credit: NASA/ETH Zurich/Patrizia Will)

below:

A lunar meteorite dubbed LAP 02436, which researchers analysed for noble gases. (Image credit: ETH Zurich/Patrizia Will)



Naming Exoworlds Competition 2022

Are we participating New Zealand?

Cultures around the world have long made connections with objects in the natural world by giving them names in their native tongues. Many civilisations have developed their own stories, mythologies, and cultural contexts around specks of light in the heavens above. Through these connections we eventually found our place among the stars. This is the story of how astronomy came to be among the earliest of the disciplines we now call science, and the beginning of humanity's eternal quest to understand the Universe around us.

Reflecting the truly international interest in astronomy, the first NameExoWorlds competition, in 2015, named 19 ExoWorlds with over half a million votes from 182 countries and territories. In 2019, as part of the IAU's centennial celebrations, the NameExoWorlds competition offered every country the chance to name one planetary system, comprising an exoplanet and its host star. As part of this contest, 112 countries organised national campaigns that involved the direct participation of over 780 000 people worldwide. The systems to be named by NameExoWorlds 2022 are of special interest, as they are among the first exoplanet targets of the James Webb Space Telescope (JWST).

Read more here
https://www.nameexoworlds.iau.org/2022edition

How can we participate?

Create a team composed of students and teachers, astronomy enthusiasts, amateurs astronomers and exoplanetary scientists;

1. Create and implement an outreach event related to exoplanets. This could be one of the following, but not limited to: An event aimed to educate the public about exoplanets, their discovery and significance, the possibility of life elsewhere, etc. The outreach activities could involve direct hands-on engagement, public lectures, or online interactions.
2. The teams are free to choose their method of selecting the name to be submitted in the proposal. They could, for example, incorporate voting from participants after the outreach event or have the voting done separately beforehand and announce the chosen name as part of the outreach event.
3. Register your team and submit your name proposal (written format + video) (via this form).

Important Dates:

Naming Process
8 August- 11 November 2022
National Vetting Process
15 November 2022 - 15 December
Voting and Selection of the Names
16 December 2022 to 16 March 2023
Public Announcement of Results
20 March 2023.

The Evening Sky in September 2022

Three bright planets light up the evening sky along with some of the brightest stars. At the beginning of the month Mercury appears as a lone medium-bright white star low in the west at dusk. It sets two hours after the Sun. On the opposite side of the sky is Saturn, the same brightness as Mercury but cream-coloured. Around 8 pm golden Jupiter rises in the east. It is the brightest 'star' in the night sky. It rises earlier each night so is in the evening sky at dusk by the end of September. Mercury fades and falls lower in the twilight, disappearing by the 18th.

Jupiter and Saturn are worth a look in any telescope. A small telescope shows Jupiter's disk and the four 'Galilean' moons lined up on each side of it. A larger telescope shows stripes across the planet made by warm and cold clouds on Jupiter. Occasionally the shadow of a moon crosses Jupiter, making a tiny black spot. Jupiter is at its closest for this year, 590 million km away. Almost any telescope will separate the planet and the ring. Saturn is 1350 million km away mid-month. The Moon will be near Saturn on the 8th and near Jupiter on the 11th.

Of the bright stars, Arcturus is on the northwest skyline. Its orange light is often broken up into red and green twinkling. On the north skyline is Vega, a white star, the second-brightest northern star after Arcturus. Vega is balanced by Canopus, the brightest true star in the evening sky, skimming along the southern skyline. Both stars are shining through a lot of air which makes them twinkle colourfully. From northern New Zealand the star Deneb can be seen near the north skyline in the Milky Way, well right (east) of Vega.

Deneb is the brightest star in Cygnus the Swan, a large cross-shaped constellation.

Orange Antares, northwest of the zenith, 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. 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. 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.

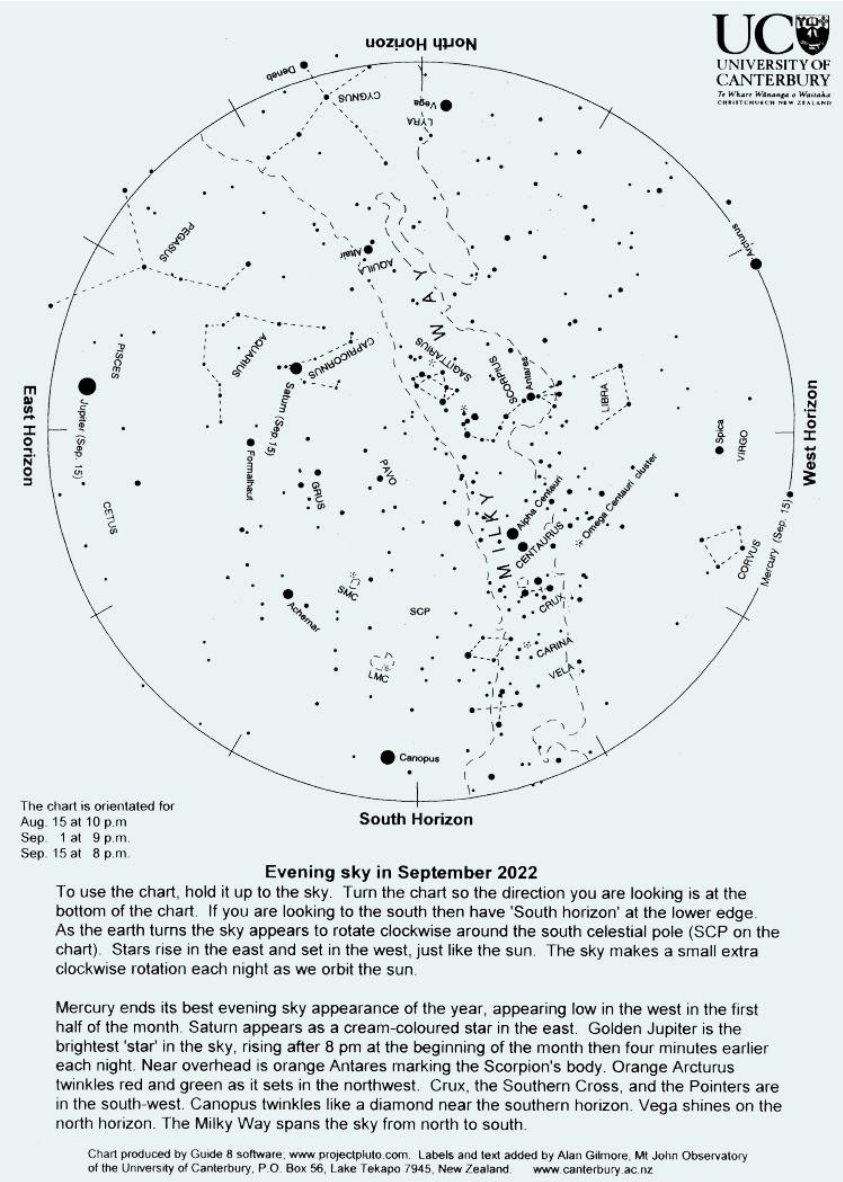
The Evening Sky in September 2022

On moonless evenings in a dark sky the Zodiacal Light is visible in the west. It is a broad faint column of light extending upward (around Mercury at the beginning of the month.) 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.

Mars is in the morning sky (so not on the chart), rising after 1 a.m. It looks like an orange-red star, brighter than Saturn but much fainter than Jupiter. At the beginning of the month it will be between the Pleiades/Matariki star cluster and Aldebaran, the brightest star in Taurus. Aldebaran has a similar colour to Mars but is fainter. The Moon will be near Mars on the morning of the 17th.

Alan Gilmore

Find all (large) charts here.



Evening sky in September 2022

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.

Mercury ends its best evening sky appearance of the year, appearing low in the west in the first half of the month. Saturn appears as a cream-coloured star in the east. Golden Jupiter is the brightest 'star' in the sky, rising after 8 pm at the beginning of the month then four minutes earlier each night. Near overhead is orange Antares marking the Scorpion's body. Orange 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 north 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

Comet C/2017 K2 (PANSTARRS)

This comet is moving slowly along Scorpio's claws, the curve of stars below Antares.
On August 20 it is 2.0 AU, 300 million km, from Earth and 2.4 AU, 360 million km, from the Sun.
It is moving away from Earth but nearer to the Sun.

The ephemeris below is from August 20 to September 28 at 8h UT, 8 pm NZST.
m1 is the total magnitude, the brightness of a star defocused to the size of the comet. It is a lot fainter than a focused star of the given magnitude.

d	R.A.(2000) Dec.	m1	d	R.A.(2000) Dec.	m1
20	16 04.8 -18 32		09	15 55.2 -25 42	
21	16 04.0 -18 54		10	15 55.1 -26 03	
22	16 03.2 -19 17	6.7	11	15 54.9 -26 23	6.7
23	16 02.5 -19 39		12	15 54.8 -26 43	
24	16 01.8 -20 02		13	15 54.8 -27 03	
25	16 01.2 -20 24		14	15 54.7 -27 23	
26	16 00.5 -20 46		15	15 54.7 -27 43	
27	16 00.0 -21 08	6.7	16	15 54.7 -28 03	6.6
28	15 59.4 -21 30		17	15 54.8 -28 23	
29	15 58.9 -21 51		18	15 54.8 -28 43	
30	15 58.4 -22 13		19	15 54.9 -29 02	
31	15 57.9 -22 34		20	15 55.1 -29 22	
01	15 57.5 -22 56	6.7	21	15 55.2 -29 41	6.6
02	15 57.1 -23 17		22	15 55.4 -30 01	
03	15 56.7 -23 38		23	15 55.6 -30 20	
04	15 56.4 -23 59		24	15 55.8 -30 40	
05	15 56.1 -24 20		25	15 56.0 -30 59	
06	15 55.9 -24 41		26	15 56.3 -31 18	
07	15 55.6 -25 01	6.7	27	15 56.6 -31 38	6.6
08	15 55.4 -25 22		28	15 56.9 -32 00	

AOTEAROA ASTROTOURISM ACADEMY

'Astronomy, The Night Sky & The Universe'
An Immersion Course

Course Date: Friday 21 to Sunday 23 October 2022.
Location: Royal NZ Yacht Squadron, Auckland.

Course Topics:

- New Zealand's Night Sky & The Universe – an introduction
- Observational Astronomy – underlying principles & practical application
- Astrophotography - technical guidance & practical usage
- Workshops - Astrophotography, Astrotourism & Outreach sessions
- Telescopes & Binoculars – technical guidance & practical usage
- Maori astronomy – an introduction
- Practical Stargazing – 'hands-on' with traditional & digital scopes & binoculars

Course Tutors:

- Emeritus Professor of Astronomy, University of Canterbury – Dr John Hearnshaw
- IDA Board Member & Astrotourism Specialist– Nalayini Davies
- Mt John Observatory, Tekapo, former Superintendent - Alan Gilmore
- Expert Observational Astronomer & Astrophotographer – John Drummond
- Expert Astrophotographer & Author – Dr Stephen Chadwick
- Director, Waiheke Island Observatory – Gareth Davies

For People Interested In:

- NZ's Night Sky & The Universe–what you can see & what lies beyond
- Astronomy– what objects are observable & how best to observe them
- Astrophotography today – the products & the practice
- Astrotourism and/or Outreach – how to conduct these successfully
- The Dark Sky Movement in NZ – what it is & how you can participate
- Buying a Telescope or Binoculars – which is best for you & how to use them

Also Included:

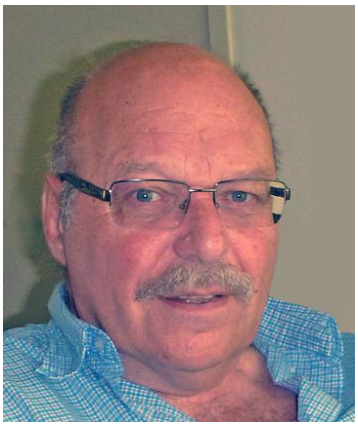
- Evening Reception on Friday with drinks & snacks
- Morning Tea, Lunch, Afternoon Tea on Saturday & Sunday
- A Stargazing Session on one evening (weather permitting)
- Course Session Handouts
- Recommended Reading & Resource List

Course Cost: $797 per person

Contact: John Hearnshaw on: john.hearnshaw@canterbury.ac.nz or
Visit the AAA website at: https://aaanz.org to book and for attendee testimonials.

Please Note: On-line registration is now open and attendee numbers are limited

Your new Editor



After a University career in Space Geodesy overseas, I came to New Zealand some 25 years ago and ended up teaching Physics and Mathematics at senior secondary school. This, together with two tenures as a member of the Board of Trustees, gave me a real passion for Education. I helped to build an observatory at the school grounds and in retirement it seemed only natural to start talking about astronomy to the local community and students. Over the years I developed lectures and ultimately courses in Astronomy. These were face-to-face at the Oxford Observatory, but since last year these are now delivered on Zoom for a much wider audience.

Being actually older than the illustrious previous editor of the RASNZ newsletter, who has done this for twenty years, I see myself as a "transition" editor. I am honoured to be part of the current process within RASNZ to present ourselves in a modern and efficient way. The aim is that by next year we will have found a young(er) person to take over the editor role, continuing this new style of presentation.

Erik Vermaat

Quotes of the Month

On Velocity Time Dilation: "You would have to fly around the world four hundred million times to add one second to your life, but your life would be reduced by more than that by all those airline meals". Lecture 1991, Stephen Hawking.

On Life elsewhere: "Solid proof that extraterrestrial intelligence exists is that they didn't yet contact us", Stephen Hawking.

"I had a rose named after me and I was very flattered. But I was not pleased to read the description in the catalogue: - 'No good in a bed, but fine against a wall.' "- Eleanor Roosevelt

How to Join the RASNZ

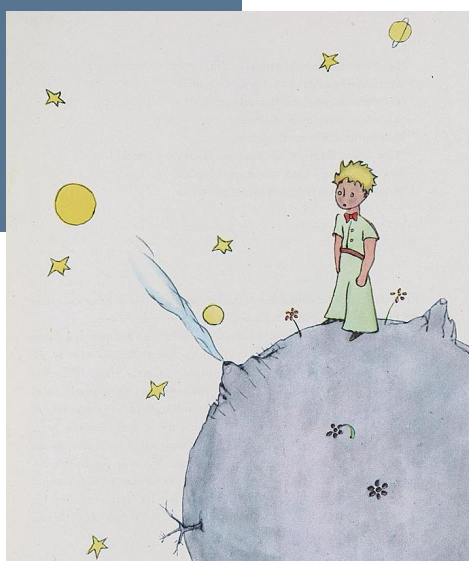
RASNZ membership is open to all individuals with an interest in astronomy in New Zealand. Information about the society and its objects can be found at http://rasnz.org.nz/rasnz/membership-benefits

A membership form can be either obtained from treasurer@rasnz.co.nz or by completing the online application form found at Membership Application

Basic membership for the 2022 year starts at $40 for an ordinary member, which includes an email subscription to our journal 'Southern Stars'.

Until next Issue

Contributions must be in by the 15th of the month.



Contact Us

Erik Vermaat
Phone: 022 1034618
enews@rasnz.org.nz