SkyWAAtch

Monkey Head Nebula

Mauri Rosenthal took this image of the Monkey Head Nebula, NGC 2174, from his yard in Scarsdale at the end of February. This emission nebula in the constellation Orion is principally ionized Hydrogen as indicated by the red color, and lies 6400 light years away. The stack of 16 five minute exposures was shot through a Borg 71FL lens with a Starlight Xpress SC694C camera on a guided portable iOptron mount, using a broadband light pollution filter, and processed with PixInsight.

In This Issue . . .

Events for June

WAA June Lecture

"Studying the Beginning of the Universe with the Cosmic Microwave Background Radiation"
Friday June 2nd, 7:30pm
Leinhard Lecture Hall,
Pace University, Pleasantville, NY

Our presenter, Dr. Bradley R. Johnson, will discuss Cosmology: the study of the dynamics and evolution of our Universe. Humankind has wrestled with cosmological ideas for millennia. However, unlike our ancestors, we live in a time when cosmological observables and theory can be used together to answer some of the most fundamental questions about how our Universe began. These observables are being discovered and precisely characterized thanks to new technologies that allow us to look deeply into the Universe in new ways and image the cosmological landscape clearly for the first time. Dr. Johnson's talk will highlight one of the most information-rich cosmological observables: the cosmic microwave background radiation (CMB)—a bath of photons that permeates all of space and carries an image of the Universe as it was 380,000 years after the Big Bang.

Professor Johnson received his Ph.D. from the University of Minnesota in 2004. Before joining the faculty at Columbia University, he was a postdoctoral researcher at NASA Goddard Space Flight Center, University of California, Berkeley, Oxford University and Cardiff University. Free and open to the public. Directions and Map.

Upcoming Lectures

Pace University, Pleasantville, NY

There will be no lectures for the months of July and August. Lectures resume in September with Member Presentations Night.

Starway to Heaven

Saturday June 17th, Dusk.
Ward Pound Ridge Reservation,
Cross River, NY

This is our scheduled Starway to Heaven observing date for June, weather permitting. Free and open to the public. The rain/cloud date is June 24th. **Important Note**: By attending our star parties you are subject to our rules and expectations as described here. Directions and Map.

New Members. . .

Abdul Mirza - Oakland Gardens
William Rothman - Scarsdale
Steve Miller - South Salem

Renewing Members. . .

Chris and Regina Di Menna - Brewster
Jonathan Williams - New Rochelle
Gary Miller - Pleasantville
Red Scully - Cortlandt Manor
Paul Alimena - Rye
Garfield Boston - Yorktown
Donna Cincotta - Yonkers
Arun Goyal - Katonah
Jon Gumowitz - White Plains
Robert Brownell - Peekskill
Dante Torrese - Ardsley
Jordan Webber - Rye Brook

RAC SUMMER STAR PARTY
July 21st through July 30th

The Rockland Astronomy Club is sponsoring its summer star party July 21th through July 30th. RAC holds the longest and most exciting star party, geared to both the serious observer, imager, and the whole family. The location in the Berkshires is known for its pristine dark skies, and gorgeous arching Milky Way. Don't miss the Opening Festival and StarBQ with live music. For details go to:

http://www.rocklandastronomy.com/ssp.html.

Wanted Assistant Editor

The WAA newsletter (the *SkyWaatch*) is seeking an Assistant Editor. If you can help, please let us know. Your participation in editing, compositing and proofreading tasks or submitting articles or images, will be much appreciated. Email Tom at waa-newsletter@westchesterastronomers.org.

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the WAA website.

ALMANAC
For June 2017 by Bob Kelly


Jun 1 Jun 9 Jun17 Jun 24

According to the Canadian Observer's Handbook, shadows of two moons at once can be seen on Jupiter from somewhere in the USA or Canada eight times in June. Every 9 hours and 51 minutes, Jupiter's equatorial clouds complete a rotation around the planet. Jupiter's Great Red Spot can be seen for about three hours during each of Jupiter's spins.

Seventeen times, Io will complete a trip around Jupiter this month, Europa eight times, Ganymede four times and Calisto gets around almost twice. Lots of moving parts. Lots to see. Check Sky & Telescope or other astronomical web sites if you want to see specific events. Or, just step out on a steady night and turn the 'scope loose on this 39 arc-second-wide sky-mark moderately high in the southern sky after sunset.

Saturn follows five hours later. Lower in the south, and not getting highest until after midnight, it's still brighter than usual as its rings are tipped open by 26.7 degrees, the most for 2017 and almost the most ever. We get closest to Saturn for the year at mid-month.

Venus hangs low, but gets a bit further out into the dark pre-dawn sky. It's at its brightest, half lit, low in the early morning brightness; farthest out from the Sun on the 3rd.

The new Moon is another invisible supermoon on the 23rd. Look out for larger-than-normal tides that week. The full Moon on the 9th is the year's smallest. Even then, even mighty Jupiter is still only the size of a large lunar crater, from our point of view.

While everyone is graduating this month, Mercury is a drop out in the morning sky, passing by the Sun on the 21st.

Mars is finally fading into the evening twilight. It won't be visible when it gets back in the morning sky until September.

The dark side of the Moon runs over the plus 2.9 magnitude Gamma Virginis late evening about 10:50pm on the 30th. It's a double star, but they get blocked out by the Moon at almost the same time, but it's still a two-for-the-price-of-one.

We get only eight hours and 53 minutes of 'night' on the 21st, the Northern Hemisphere's Summer Solstice, which occurs at 12:24pm EDT. There's even less astronomical 'dark', at five hours and 11 minutes. The earliest sunrise happens two weeks before the solstice and the latest sunset is about two weeks after it.

But the dark is really dark! Almost no Milky Way this month, until Sagittarius gets well up well after dark.

ISS makes several passes each evening through the 12th.

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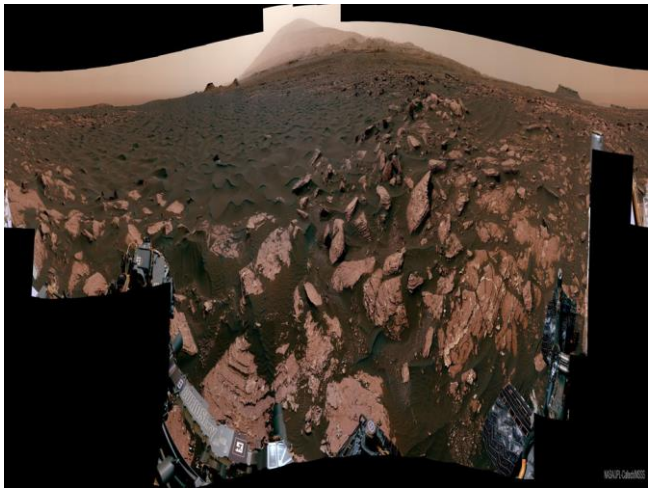


⬅ Day at the Beach

With summer's arrival, maybe your thoughts are turning towards a weekend at the beach. This was once a beach—on ancient Mars. The featured 360-degree panorama, horizontally compressed, was taken by the robotic Curiosity rover currently exploring the red planet. Named Ogunquit Beach after its terrestrial counterpart, evidence shows that at times long ago the area was underwater, while at other times it was at the edge of an ancient lake.

Credit: APOD

Image: NASA, JPL-Caltech, MSSS

An Astronomy Trip to Chile: Part 2 – La Silla & Vicuña

Larry Faltz

Part 1 of this series can be found in the May 2017 issue of Sky*WAA*tch.

Although we had come back from Collowara Observatory in the Chilean mining town of Andacollo to our hotel in La Serena well after 1 am, we had to get up early the next morning, March 21st, eat breakfast and pack our bags for the trip to La Silla Observatory. Later in the day we'd be passing back through La Serena but travelling another 35 miles east to the small city of Vicuña, where we would stay 2 nights.

This part of Chile, the Coquimbo region, is the site of many of the largest and most important research observatories and a half dozen fine "tourist" observatories. The cold Humboldt Current cools the off-shore air and condenses atmospheric moisture on the western side of the coastal mountains. Even so, there isn't a lot of local vegetation. Just a few miles to the east the sun shines almost perpetually, humidity is extremely low and air flow is laminar, resulting in up to 320 cloudless nights a year with excellent transparency and seeing. Coquimbo is the southernmost part of the Atacama Desert, known as the *Norte Chico* (Near North). Major research observatories are located not that far inland from the coast. La Silla, Cerro Tololo, Las Campanas and Gemini South are each about 35 miles from the ocean, while the site of the Very Large Telescope quartet of 8.2-meter instruments at Cerro Paranal, a few hundred miles further north, is only 10 miles inland.

Although administrative offices for La Silla are in La Serena, the observatory itself, 55 miles northeast as the crow flies, is perhaps 100 miles by road, taking into account all the twists, turns and grades. Our tour bus took almost 3 hours to make the drive. North from La Serena the Chilean section of the Pan-American Highway, the only north-south highway in the country, hugs the coast for about 15 miles. On the day we travelled it was shrouded in the kind of fog one often gets along the California coast. Just north of the fishing village of Los Hornos, the nicely paved 2-lane motorway turned inland and climbed through a range of low, dry mountains into intense sunshine, and then went through a broad, arid valley until we finally reached the turnoff for the observatory. We passed by an enormous solar panel farm, seemingly several square miles in extent, supplying power to the national grid. There's probably no better place in the world for that kind of installation.

After passing more enormous solar panel fields under construction, we came to the gate for the facility, an area with a few small buildings and some sparse vegetation. Another 45 minutes of winding but well-paved road brought us to the mountaintop observatory, at an elevation of 2400 meters (7,875 feet).

Along the highway to La Silla

The European Southern Observatory was founded in 1962 by a consortium of European countries, with 16 nations now participating. Headquartered in Germany with a major office in Santiago and a local ones in La Serena and Anofagosta, ESO operates three observatories in Chile: La Silla, Cerro Paranal and ALMA (the Atacama Large Millimeter Array). ESO just started construction of the Extremely Large Telescope (39 meters diameter) on Cerro Amazones, 13 miles east of Cerro Paranal. Each country contributes to the total budget of €198 million proportional to its GDP.

Getting close to the observatory

We were met at the visitor's center by Hernan Julio Illanes, who does outreach for ESO at La Silla. He describes himself as a "journalist, lawyer, amateur astronomer, university teacher, writer, communicator, polyglot...a Century XXI renaissance man" and indeed he was knowledgeable and enthusiastic about nearly everything, including a vast amount of technical information about the telescopes and their discoveries.

La Silla as seen from the catwalk of the 3.6-meter telescope

ESO is not itself an astronomy research organization: it designs, builds and operates telescopes for use by astronomy organizations. There is a scientific committee of astronomers from academic institutions that accepts research proposals from astronomers and assigns time on the instruments. The competition is fierce: only about 1 in 5 proposals are accepted. In exchange for hosting the observatory, Chilean institutions receive 10% of the scope time. Hernan told us that Chile now has 50% of the world's astronomy research capacity and within 10 years, when the Extremely Large, Giant Magellan and Large Synoptic Survey telescopes are completed, it will have 70%. This is a testament to the observing conditions and the hospitality of the host nation. Even the Chinese are building a 6-meter instrument on Cerro Paranal. Chile is indeed "astronomy-land."

The Chilean government has carved out tax exemptions for the astronomical facilities (apparently this was the one thing that Salvador Allende and Augusto Pinochet agreed upon) to support their operations. Hernan said "We lend the land, and the stars." Contact with astronomers from around the world has stimulated growth in academic astronomy in Chilean universities. In 1995 there were 15 astronomy graduate students in the country, but now there are 300. All of the data coming from the ESO's instruments is archived. For 6 months it is available exclusively to the astronomers who obtained it, but then it is made available to anyone who wants to download it. Students have discovered exoplanets hidden in the archived data, which they can access without submitting formal proposals. The ESO archives now hold over 1.5 million images and spectra in 65 terabytes of data.

Construction on La Silla started in 1969. Over the years, many telescopes have been placed there, both under ESO's direct control and operated by national or university observatories in association with ESO. As is the case at most large observatories, some have been decommissioned as technology advanced to make them obsolete. Construction started on the largest telescope, a 3.6-meter Cassegrain on a horseshoe mount, in 1970. The telescope came on line in 1977 and has been kept productive by constant upgrades. Its main purpose today is exoplanet research, but over the years it has had a broad range of inquiry and has captured many spectacular wide-field deep space images. The New Technology Telescope (NTT), a 3.58-meter Ritchey-Chrétien reflector, was the first telescope in the world to have active computer control of its main mirror when it was inaugurated in 1989. Among the other telescopes on the site is the TRAPPIST–South (TRAnsiting Planets and PlanetesImals Small Telescope–South) instrument that discovered a planetary system around a star 40 light-years away ultimately found to be made up of 7 Earth-like planets.

Elyse Faltz and Cheryl Beatty with the 3.6 meter dome (on the hill) and the dome of the Swiss 1.2 meter Leonhard Euler telescope on the left. Taken from in front of the NTT

After his presentation in the visitor's center, Hernan accompanied us on the bus for the short drive to the 3.6 meter telescope, housed in a large dome on its own hill. The telescope is typical of 4-meter class instruments of its era, such as the Mayall telescope at Kitt Peak and the Victor Blanco telescope at Cerro Tololo that we would be visiting the following day. The dome is expansive, and within it the telescope sits

in a massive equatorial horseshoe. A cage under the primary mirror is packed with equipment, but since 2008 the only research instrument in use is HARPS, the High Accuracy Radial velocity Planet Searcher, a spectrograph attached to the Cassegrain focus operating at f/8 with a resolution on 0.2 arc-seconds. HARPS detects wobbles in a star's velocity due to the presence of exoplanets. It can measure displacement velocities as low as 3.5 km/h, essentially a walking pace. Among instruments for finding low-mass exoplanets, HARPS is considered the international leader. As of this writing, some 614 scientific papers have come from data obtained with HARPS.

The 3.6 meter telescope. Photo by Bob Reynolds, Houston, TX, a member of our group. Used with permission.

The 3.6-meter telescope was one of the first large instruments in the world to use adaptive optics, with a prototype system installed in the 1980's.

Until fairly recently, telescopes were controlled from consoles on the floor of the instrument. However, heat from scope controls and telescope operators adds distortion to the wavefront, degrading the quality of images and spectra. Louvers were installed in the dome to permit airflow across the primary, but that wasn't enough, and so the telescopes are now operated remotely from a building on the other side of the campus. No one is inside the dome when it is making observations. The days of an astronomer sitting in the secondary observing cage, calling instructions down to a telescope operator sitting at a console under the instrument (who is undoubtedly drinking a steaming cup of coffee) are long gone.

Another view of the primary case and horseshoe polar mount of the 3.6-meter telescope.

Polar drive bearing (silver ring) on the horseshoe mount

Elyse on the catwalk of the 3.6-meter dome. The small dome housed a Coudé auxiliary telescope, no longer in use.

We took a walk around the catwalk outside the dome, looking over the main part of the observatory complex to the arid mountains, visible in every direction.

After exploring the telescope for a while longer, we went back to the visitor's center and then walked up the incline to the New Technology Telescope. This 3.58-meter instrument on an alt-azimuth mount is housed in a barn-like building. Like many newer alt-az instruments (the 6.5-meter MMT at Mt. Hopkins in Arizona comes to mind), the telescope seems to barely fit into its enclosure. That's because the entire structure rotates with the telescope, so in effect it only has to move in altitude inside the dome. There are flaps in the building to ensure laminar air flow across the surface of the primary mirror.

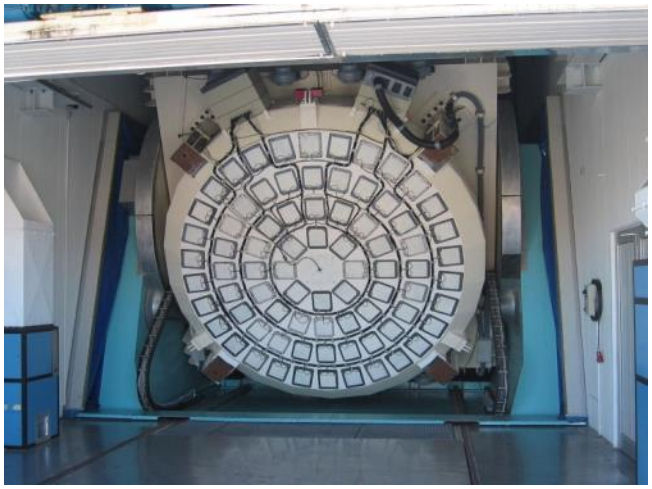
New Technology Telescope

The NTT was the first telescope in the world to have the main mirror's figure regulated by computer control, known as "active optics." The relatively thin Zerodur mirror is supported on 75 computer-controlled actuators (along with 24 lateral actuators) that ensure that the mirror's figure is perfectly maintained regardless of the scope's position. The secondary also has a computer-controlled figure. This differs from "adaptive optics," the system that controls for atmospheric distortion using a laser, a guide star, or both. Among the other "new technology" innovations in the telescope is water cooling of all of its motors and electrical junction boxes to further minimize image-disturbing heat inside the building. Much of the technology of the NTT was developed in preparation for building the 8.2-meter Very Large Telescopes, operated by ESO at Cerro Paranal.

3.58 meter NTT mirror showing some of the lateral actuators and the central perforation

The NTT's primary mirror is f/2.2. The resolution is better than 0.15 arc-seconds. Although the NTT mirror has a central perforation, it is not currently used for observations. A controllable 45-degree mirror projects the optical beam from the secondary to a Nasmyth focus on either side of the instrument, operating at f/11. Each beam comes to focus in a separate, thermally-controlled room, one housing the ESO Faint Object Spectrograph and Camera version 2 (EFOSC2) sensitive to visible light and the other the quaintly named Son of ISAAC (SOFI) operating in the near infrared (0.8-2.5 μm). ISAAC *père* is an imaging spectrometer at the VLT on Cerro Paranal.

Visible light spectrograph EFOSC2 with its housing removed



Active optics actuators under the NTT mirror (ESO)

Until 2003, the NTT was operated from inside the building (it's hard to call the angular squared-off structure a "dome") but operations were relocated for the same reasons as the 3.6-meter. We visited the control center next, passing a number of small domes on the way, one which houses the TRAPPIST-South telescope that was so much in the news in early March. TRAPPIST is a 60 cm (23.5 inch) Ritchey-Chrétien reflector on a German equatorial mount that is operated entirely remotely from the University of Liège in Belgium, in cooperation with Geneva Observatory in Switzerland. Last year this telescope discovered 3 Earth-like planets surrounding the cool dwarf star 2MASS J23062928-0502285, located some 39.5 light-years from Earth. This discovery prompted other telescopes to study the system. Observations with the Spitzer space telescope and the Very Large Telescopes at Cerro Paranal found 4 more planets. Analysis showed that three of them were in the "Goldilocks" zone and had masses that might make them capable of maintaining an atmosphere.

The main operations center houses workstations for the NTT, the 3.6 meter telescope and a 2.2-meter Ritchey-Chrétien reflector instrument owned and used by the Max Planck Institute (again with 10% reserved for Chilean astronomers). This telescope carries the 67-megapixel Wide Field Imager, with a field as large as the full moon and sensitivity down to 24th magnitude. At night, the control center must be a busy place. In addition to large numbers of computers and screens at the three work areas, there were many books, ephemerae, multi-volume astronomical catalogues and even an old Norton Star Atlas with Epoch 1950.0 coordinates. One suspects these were left by the many astronomers who worked here over the years and they add a quaint bit of history to the place. Astronomical catalogues today must be kept on computer. For example, the All-Sky Data release from 2MASS (the 2-micron all-sky survey) in 2003 contains information on 470,992,970 point sources and 1,647,599 extended sources, most of which are galaxies. It also includes 4,121,439 atlas images. And if you want it, it's cheaper than a book (which might run to several million pages): it's free at the 2MASS web site!

Hernan Julio and our group in the La Silla control room

A lot of data is collected by the instruments each night. Although files are kept on the observatory's UNIX servers, a high-speed communications system is capable of transmitting each night's data to ESO headquarters in Germany in about 20 minutes.

3.6-meter telescope and Swedish submillimeter dish

On our way out of the observatory, we stopped by the decommissioned Swedish-ESO Submillimeter telescope, a 15-meter dish that operated from 1989 to 2003. Although it was once the largest submillimeter instrument in the southern hemisphere, its capabilities were completely dwarfed by ALMA, which we visited

a few days later, and so it's no longer operational. It's a rather lovely, if lonely, device.

Another view of the Swedish telescope

We got back on the bus for the long trip back to La Serena and then on to Vicuña, with a late box lunch of sandwiches en route. Hernan showed us a beautiful new astronomy magazine that he just began publishing, *AstroVida*, with articles in Spanish and English, most by Chilean astronomers. Their very fine web site with up-to-the minute astronomical news is www.astrovida.cl and the on-line text can be translated into English. Take a look!

Hernan Julio (L) and Kelly Beatty exchanging copies of their magazines

Passing through La Serena, we dropped Hernan off near his home and headed east into the fertile Elqui Valley, an ancient agricultural area made prolific by modern technology. The Elqui River carries water from the Andes down to La Serena and out to the sea. An 83-meter high dam was built in 1999, creating a 1,900 acre reservoir. The Puclaro Dam's design and construction had to take into account Chile's frequent seismic activity. Irrigation in the valley relies on sensors to detect ground moisture content, feeding data to computers that regulate watering of the 67,000 acres of grapes and fruit that surround the reservoir. Because there had been a lot of rain in the recent Chilean summer, the reservoir was filled to the brim and water was cascading over the spillway. A windsurfer and a parasailer were enjoying themselves in the late afternoon sun. The road from La Serena to Vicuña runs along the south side of the reservoir, and from time to time we could glimpse the domes of the Cerro Tololo observatory on the distant mountains beyond the rich fields of grapes, oranges and other crops. There are signs along the road dubbing it *Ruta de Las Estrellas* (Route of the Stars) and indicating the location towns and private observatories in the area. In addition to its agricultural and astronomical associations, Vicuña was the birthplace of Gabriela Mistral (1889-1957), a poet and diplomat who was the first Latin American to receive the Nobel Prize for literature (1945). She is lionized all over Chile with streets, plazas and even a university named after her.

A view south from the *Ruta de Las Estrellas* across vineyards to the mountains. The Cerro Tololo observatory can be seen on the distant peak just to the right of the hill in the center.

We arrived at the new and rather lovely Hotel Terral, just 2 blocks from Vicuña's main square. A central courtyard with a fountain led to a wing of large and comfortable rooms. We had dinner in their decent restaurant and got ready for a short bus trip to the Mamalluca Observatory for another night of viewing. But before we boarded the bus, we were informed that the *alcalde* (mayor) of Vicuña wanted to meet our group. Apparently he found out that a delegation of American amateur astronomers under the auspices of Sky & Telescope magazine was passing through his town, and, skilled politician that he is, arranged for a meet and greet photo-op.

So, intrigued by this sudden diplomatic stroke, we went over to the municipal building on the town

square (it seems all Chilean towns have their municipal buildings on their town squares, which actually makes sense) and were ushered into a conference room. Almost immediately Alcalde (Mayor) Rafael Vera appeared, a dapper and fit man with a warm smile. Translated by a young staff member who spoke English quite well, the mayor welcomed us and told about his desire to promote Vicuña as a destination for astronomy tourism. He presented our leaders, Kelly Beatty and Gary Spears, with a bottle of Elqui Valley wine (which turned out to have his personal label on it) and a small plaque, and Kelly, thinking quickly, gave him a planisphere for 30° South that he had with him, as well as a copy of Sky & Telescope. We then went outside and took a group photo, which sure enough appeared the next day on the Vicuña web site along with press release about the meeting.

Gary Spears, Vicuña Alcalde Rafael Vera and Kelly Beatty

Our group photographed with the *Alcalde*.

You might actually think about visiting Vicuña in two years. On July 2, 2019, a total solar eclipse will be visible in La Serena and Vicuña when the path crosses Chile and Argentina, its only landfall. Organizers are already offering trips to that destination, and the surrounding research and tourist observatories will make the excursion very attractive for anyone interested in astronomy.

It was a short ride on the bus to Mamalluca Observatory, just 5.6 km northeast of town. Mamalluca was established in 1998 by the city of Vicuña. The facility has a lecture hall, a couple of a large reflectors on a deck and a 12" Meade go-to SCT (donated by the Cerro Tololo observatory) in a dome with a cleverly constructed spiral ramp that eliminates the often daunting problem of negotiating steps in the dark. The lights of nearby Vicuña were somewhat distracting and lighting control on the property was not optimal, but the sky was still reasonably dark. The Small Magellanic Cloud was not as prominent as it was the previous night at Collowara. If he wants to maximize Vicuña's potential as an observing destination, the Alcalde will need to temper the city's growth with better lighting control. Apparently Cerro Tololo and Gemini South have made a bit of headway in reducing light trespass by getting the town to upgrade some of its lighting to IDA-compliant fixtures, but more will be needed to preserve the dark sky.

Dome of the 12" SCT at Mamalluca Observatory (Vicuña)

Our guide, another Hernan, gave us an orientation similar but more extensive to what we had experienced at Collowara. He identified some of the constellations by their names in the native languages of the area, particularly Quechua, the Incan tongue that is still spoken by about 8 million people in the mountains of central South America. The telescopes were aimed at many of the objects we had seen the night before plus some new ones in the incredibly rich southern sky. We spent some time using our 10x50 binoculars while waiting for our turn at the scopes, and in particular we looked at some objects that were not scope targets this night: the Beehive, the Orion Nebula and the Pleiades among them.

One of the highlights was a sprightly local dog named Sirius. After Elyse made friends with this little mongrel, he decided to board the bus for the trip back to town, but alas we had to leave him under the stars. ■

The Fizzy Seas of Titan

Marcus Woo

With clouds, rain, seas, lakes and a nitrogen-filled atmosphere, Saturn's moon Titan appears to be one of the worlds most similar to Earth in the solar system. But it's still alien; its seas and lakes are full not of water but liquid methane and ethane.

At the temperatures and pressures found on Titan's surface, methane can evaporate and fall back down as rain, just like water on Earth. The methane rain flows into rivers and channels, filling lakes and seas.

Nitrogen makes up a larger portion of the atmosphere on Titan than on Earth. The gas also dissolves in methane, just like carbon dioxide in soda. And similar to when you shake an open soda bottle, disturbing a Titan lake can make the nitrogen bubble out.

But now it turns out the seas and lakes might be fizzier than previously thought. Researchers at NASA's Jet Propulsion Laboratory recently experimented with dissolved nitrogen in mixtures of liquid methane and ethane under a variety of temperatures and pressures that would exist on Titan. They measured how different conditions would trigger nitrogen bubbles. A fizzy lake, they found, would be a common sight.

On Titan, the liquid methane always contains dissolved nitrogen. So when it rains, a methane-nitrogen solution pours into the seas and lakes, either directly from rain or via stream runoff. But if the lake also contains some ethane—which doesn't dissolve nitrogen as well as methane does—mixing the liquids will force some of the nitrogen out of solution, and the lake will effervesce.

"It will be a big frothy mess," says Michael Malaska of JPL. "It's neat because it makes Earth look really boring by comparison."

Bubbles could also arise from a lake that contains more ethane than methane. The two will normally mix, but a less-dense layer of methane with dissolved nitrogen—from a gentle rain, for example--could settle on top of an ethane layer.

In this case, any disturbance—even a breeze—could mix the methane with dissolved nitrogen and the ethane below. The nitrogen would become less soluble and bubbles of gas would fizz out.

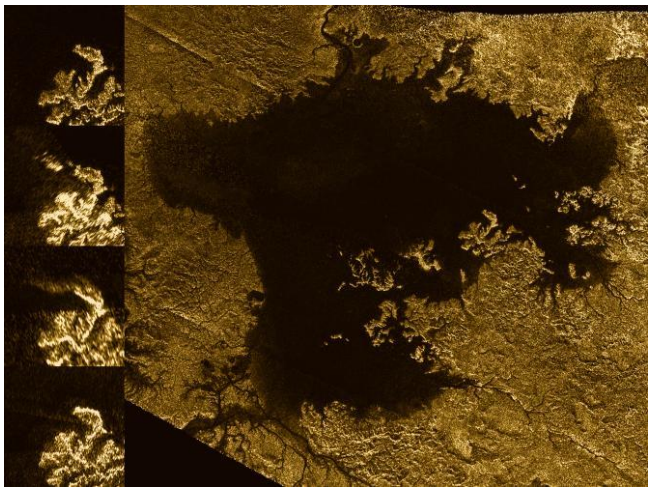
Heat, the researchers found, can also cause nitrogen to bubble out of solution while cold will coax more nitrogen to dissolve. As the seasons and climate change on Titan, the seas and lakes will inhale and exhale nitrogen.

But such warmth-induced bubbles could pose a challenge for future sea-faring spacecraft, which will have an energy source, and thus heat. "You may have this spacecraft sitting there, and it's just going to be fizzing the whole time," Malaska says. "That may actually be a problem for stability control or sampling."

Bubbles might also explain the so-called magic islands discovered by NASA's Cassini spacecraft in the last few years. Radar images revealed island-like features that appear and disappear over time. Scientists still aren't sure what the islands are, but nitrogen bubbles seem increasingly likely.

To know for sure, though, there will have to be a new mission. Cassini is entering its final phase, having finished its last flyby of Titan on April 21. Scientists are already sketching out potential spacecraft—maybe a buoy or even a submarine—to explore Titan's seas, bubbles and all.

To teach kids about the extreme conditions on Titan and other planets and moons, visit the NASA Space Place: https://spaceplace.nasa.gov/planet-weather/.



Radar images from Cassini showed a strange island-like feature in one of Titan's hydrocarbon seas that appeared to change over time. One possible explanation for this "magic island" is bubbles. Image credits: NASA/JPL-Caltech/ASI/Cornell

WAA Observer's Group

From time to time, members of the club observe at Ward Pound on non-star party nights. The park has been accommodating as long as we continue to behave and follow park rules (no alcohol, no litter). Members also observe from other locations around the county. Many members have asked for some sort of communications system so interested observers could meet up and not have to observe alone.

We have created the WAA OBSERVER'S GROUP as a forum on Google. If you join this group, you can set it up so you can receive an email from another member who is looking for observing company and posts to the group.

You will need a GMAIL account, which is free. Anyone can join by going to the URL link above and clicking "subscribe to this group." It works as a forum and an email group - all of the messages are kept in the forum but you can receive the emails as they are posted. They will go to your GMAIL account so you should set up your mail program (on computer and/or smartphone) to access that account.

The link is
https://groups.google.com/forum/#%21forum/waa_observers.

Here's a report from 3 members who got together on Tuesday, May 16th after exchanging messages on the WAA Observer's Group.

Gene Lewis: Last night Mike Lomsky and Robbin Conner joined me. Robbin was using his 8 inch dob and Mike had his ES 102 ED mounted on an AVX mount. We introduced ourselves (I hadn't met them before) and chatted while we got set up. We were there well before nautical dark and had time before getting down to serious observing. We all took a look at Jupiter and had some nice views in all scopes. It was interesting to see the differences in the different scopes. Mike's refractor view was very sharp, Robbin's dob was very bright, and I think my SCT was somewhere in between. We looked at M57 as well, and were able to see it in all scopes. Mike spotted a couple of meteors and a satellite. I'm not sure what the others got to see, but the clouds started rolling in again and about 10; we called it a night. Not the most productive night but better than staying home.

Mike Lomsky: I showed up a bit before sundown hoping for better skies. It was a tough call, but having the Google Group to converse back and forth with folks was a big help. I sat in the car for a few minutes before Gene showed up, and then went out to talk to him as we discussed the hobby and the skies. My intention was to practice some AP, so I had my ES 102 ED, AV-X mount, and DSLR. While Gene and I were talking, Robbin showed up, and we decided to set up. The skies were improving. We spent some time with Gene's SCT, and had some fun learning how his Celestron EVO 9.25 worked with his iPad. A few helpful suggestions from Robbin helped me use the polar scope that I added this winter to my AV-X, and I was excited to use Celestron's new lithium-ion battery with this mount. It's a lot smaller than the previous power supplies and can hang from the mount so there's no longer a tripping hazard. Still, for me, having a good polar alignment made the full alignment faster and easier. At this point, I was excited to do some imaging. But not having used this scope much, and not at all this year, I had to stare at Jupiter a bit. Clouds were now filtering by, but I was able to get some very sharp views, and could see detail within the bands at 150x using my ES 4.7mm eyepiece. The three of us were spending time observing through each others' scopes, so it was fun to see the same object in a refractor, dob, and SCT. It really helped you get a feel for the strengths of each scope. Of course, the whole time we were also talking about our equipment and favorite viewing sites. This helped balance the time between the clearer and cloudier skies. It was during this time that I saw a satellite and 2 meteors; one a bit brighter than Jupiter for a solid second, and the other was a tiny one. I decided to go for what I was really there for, and started to setup my camera. I use a phone app to control the camera, but it seems it was either updated or I forgot how to use it. By the time I had it worked out, it was about 10, and clouds covered the sky. For me, having time to practice, the views of Jupiter, Ring Nebula, and Hercules Cluster, let alone the time to talk about our hobby with a couple of great guys made it a fun night for me.

Robbin Conner: I think Mike and Gene nailed it. It was a great night not because the sky was a perfect (it wasn't) but because there was a camaraderie sharing different equipment and experiences under the stars with a great group of fellow astronomers. Whether looking at the ring through Gene's beautiful 9.25 on an Evolution mount that operated like an observatory scope out in the field or the jewel like clarity of Mike's triplet refractor with Jupiter each scope had

something different and interesting to offer. However, most of all it was great just being out under the stars with a great gathering of people. It's what makes the club experience much richer than simply setting up a scope alone.

Unidentified Flying Object Lands at Meadow Parking Lot!

We finally had reasonably clear skies for our monthly star party on May 20th. I got to the park early as usual so I could start setting up my Celestron CPC800 and Mallincam video camera.

As I was starting to put the equipment together, I heard a faint, intermittent blowing sound. Over the next 15 minutes, it got louder until finally the top of a hot air balloon appeared over the trees to the south, It was heading north in a mild breeze. An SUV pulling a large trailer drove into the parking lot and I realized that the balloon was going to land, hopefully not on top of me and my scope! It came across the road and headed towards the field west of the parking lot, coming down and clipping a few trees as it descended. It finally reached terra firma near the southwest corner of the Meadow parking lot.

A couple of people got out of it and, with the help of the SUV driver, they disconnected the flame source and the basket, dragged the deflating balloon into the parking lot and managed to squeeze out whatever hot air was left. As they did that, the breeze started to carry it ominously towards me but they managed to wrestle it to the ground in the middle of the lot. They then rolled it up, put it in the trailer, and drove off.

Not the usual start to an observing night!

Larry Faltz

Astrophotos

Courtesy of John Paladini is an image of a ring around the Moon shot with a Canon 50mm lens.

This photo of the Northern Lights shows David Parmet during his recent trip to Iceland, taken in a field not far from Keflavik Airport (some 40km outside of Reykjavik). David's guide was Bragi Kort of Arctic Shots. Notes David: the Lights were so faint that unless Bragi pointed out the faint green glow I would have missed it.

What bizarre alien planet is this? It's planet Earth of course, seen from the International Space Station through the shimmering glow of aurorae. About 400 kilometers (250 miles) above Earth, the orbiting station is itself within the upper realm of the auroral displays. Aurorae have the signature colors of excited molecules and atoms at the low densities found at extreme altitudes. Emission from atomic oxygen dominates this view. The eerie glow is green at lower altitudes, but a rarer reddish band extends above the space station's horizon. Also visible from the planet's surface, this auroral display began during a geomagnetic storm. The storm was triggered after a coronal mass ejection impacted Earth's magnetosphere in June of 2015.

Credit: APOD
Image Credit: Scott Kelly, Expedition 44, NASA